RAILROAD GAZETTE

FRIDAY, NOVEMBER 30, 1900.

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Contributions

The Illinois Central Rail Order.

New York, Nov. 26, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

My attention has been called to a reference in your issue of Nov. 23 to a report that the Illinois Central Railroad Company had given an order for 53,000 tons of steel rails. Such is not the fact. Our purchases of 50,000 tons of rails, for delivery in each of the last four calendar years 1897, 1898, 1899 and 1900, have so far supplied our needs that, at the present price of $26 per ton, which we regard as grossly excessive, we have contracted for the delivery, in the year 1901, of only 16,500 tons of rails.

Positive knowledge of the falsity of similar reports in other newspapers of a large purchase by at least one other company, induces me to request that you will publish this letter.

STUYVESANT FISH,
President.

Highway Crossing Bells.

Boston, Nov. 12, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

In my article on "Highway Crossing Bells," published in your issue of Nov. 2, page 713, there is a mistake of one word in the last paragraph which makes it unintelligible. I am made to speak of a "street" being limited; what I said was "speed." The clause should read:

"Railroad companies have a moral obligation to protect the lives and property of the public who use the railroad or the streets leading over it to every reasonable degree, whether or not the amount of money spent is greater than would be obtained for awards of damages; and therefore the writer would be glad to see a State law compelling the use of that kind of protection best adapted to the particular situation, at every highway grade crossing over a railroad where passenger trains are run; and in cases where the speed is not definitely limited, at crossings of electric roads also; but with such safeguards for the companies that obey the law, as will prevent the recovery of damages for accidents where the negligence of the party himself was the principal cause. . . ."

GEO. W. BLODGETT.

A Standard Draft Rigging.

Chicago, Nov. 24, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I find that several motive power men do not approve of the suggestion of Mr. George Westinghouse in the *Railroad Gazette* of Nov. 23. Probably no Superintendent of Motive Power would like to see such questions as couplers and draft gear decided off hand by the managing officers, as it is, of course, held that such questions are within the province of the Master Car Builders' Association. Not even the men who disapprove of the habit which that body has formed of dodging important questions, and believe that the Association has thus lost prestige, would want to see it over-ridden in this way. Questions involving the relative economy of mechanical devices can best be handled by technical men, and the M. C. B. Association includes plenty of men capable of doing these things. It is only a question of getting to work. Possibly an outline of the opinions of a prominent motive power man on the subject of a standard draft gear may be of interest although coming second hand, and what follows is such an outline.

It is quite safe to assume that Mr. Westinghouse's standard draft gear would be his friction apparatus, to limit the recoil of the springs, combined with some suitable design of draft attachments. It is understood from Mr. Herr's talk before the Western Railway Club that the use of the Westinghouse friction mechanism does not necessarily imply that different forms of draft *attachments* now on the market cannot also be used. That is, the Westinghouse Company is selling a substitute for the springs, which can be used with a variety of attachments, and the adoption of the friction device does not preclude the use of modern attachments of various forms. It is believed that when this is understood, the several makers of draft attachments may feel more like co-operating in any movement toward a standard draft rigging.

It is held that although Mr. Westinghouse may be firmly convinced that his friction apparatus is a necessary part of any successful draft gear, it must be remembered that very little is generally known about the mechanism. Many progressive mechanical officers do not know enough about it to warrant them in recommending its use. As engineers they realize the possibilities of such a design, but at the same time they feel that they should actually know what it will do before they can conscientiously go before the higher officers with a proposition to thus add to the cost of their cars. On the other hand, they do not feel warranted in continuing the use of the present draft gear, which is known to be weak.

The conclusion is that the time is ripe for the present M. C. B. Committee on Draft Rigging to make a full report at the next meeting. If this committee takes advantage of its opportunity it should, among other things, be able to tell the next convention what capacity of draft rigging is necessary for different size cars, what are the limits of the various designs of draft gear now on the market, and what has been learned from service trials. Then many are skeptical as to whether the spring recoil is actually so dangerous as represented, and this should be studied carefully and reported on. Furthermore, instead of the Association recommending or adopting as standard any of the present designs, it is thought that certain fundamental principles of draft gear should be laid down. This should be done with a view to furthering the interchange of attachments and setting a lower limit on the strength and capacity. By outlining the principles of construction rather than a particular design the field would be open for competition. It is thought that the railroads would much prefer to have more than one make of draft gear to choose from, and that if new designs were made to conform to M. C. B. specifications for strength and typical general dimensions, one rigging could be substituted for another in making repairs.

In the opinion of at least one prominent motive power man this is the end to be sought: That the M. C. B. Association fix on the desired capacity of draft rigging for different size cars and the strength of the attachments; then specify certain leading dimensions of draft rigging so that the attachments as a whole, of different makers, will be interchangeable; make standard such detail parts of the rigging as are common to all. The idea is to treat the draft rigging question in much the same way as the coupler problem was handled, making certain general requirements which all can work up to.

W.

Traction by Compressed Air in Paris.

In our issue of April 6 last, page 212, appeared an article giving particulars of the compressed air equipment used for working the lines of the General Omnibus Company radiating from the Louvre to various suburbs of Paris. That told the conditions up to a short time preceding the World's Fair. The outside equipment there described was compressed air locomotives hauling trailers. In preparation for the Exposition traffic the company increased materially its present plant, and also its rolling stock.

The new rolling stock comprises 148 motor cars, each seating 52 persons. The motors are placed inside the frames and the Walschaert valve gear, used on the earlier engines, has been given up for the Bonnefond system of distribution. By the latter the period of admission may be reduced to 12 per cent. of the stroke, whereas, by the former it could not be got below 28 per cent. Another important change has been in the arrangement for constantly supplying heat to the re-heating water, thus avoiding the necessity of taking steam at the end of every trip, or even at intermediate points if the trip is long. Two different plans were tried to accomplish this. One of these, designed by Mr. Mékarski, has a water coil outside of the hot water tank. This coil is in a small fire-box and is connected to the upper and lower sides of the tank, thus providing for circulation. The second method of constant heating was devised by the company. This consists of a small furnace inside the tank, which works like a slow-burning stove. The fuel used for re-heating is coke, the consumption of which is very little, and the burning of so small a quantity of coke is attended with no inconvenience.

East motor car has eight car storage tubes communicating with each other and placed lengthwise of the car under the floor. These have a total capacity of 88 cu. ft. The total weight of the air storage tanks of one car is 7,500 lbs. They carry the air at a pressure of 1,138 lbs. per sq. in. (80 kilograms per sq. centimeter) and are tested up to 107 kilograms. An attempt to test one of these storage tubes (they are mild steel) to destruction failed at 300 kilograms per square centimeter; that is, the pump was not able to raise pressure beyond that point.

When air is taken in the course of the trip this charging is accomplished in two or three minutes. The rest at the terminal station is usually about six minutes. This length of time, however, is governed rather by the comfort and convenience of the men than by the time necessary for recharging. Some particulars of the traffic results of the introduction of compressed air power on these lines were given in our former article. Concerning this matter we have no later information.

Mr. Delano on Freight Yards.*

A freight yard should be considered a machine for sorting and classifying cars. The general idea in a railroad yard, judging from what I have seen in about 99 cases out of 100, is simply to make a place where cars can be stored. Those who have had occasion to trace freight know that a great part of the delays is occasioned by cars getting misplaced and lost sight of in these big yards. After watching the operation of switching something like nine years I came to some conclusions as to what was necessary in a yard.

In the first place the tracks in the yard should be straight from end to end. Stub tracks, except for team tracks and the like, should be avoided. Tracks should always have two ends, and business should enter these tracks at one end and go out at the other. This keeps the traffic going through the yard in rotation in the order in which it comes in. It is not necessary that all tracks in a yard should be the length of one train. I know it is commonly supposed that you should make a receiving yard with all tracks sufficiently long to take the longest train. I do not believe that that is anything worth striving for. Trains are not all of uniform length and in the nature of things cannot be; trains of loaded cars, trains of partly loaded cars and trains of empty cars will vary in length and there are different classes of engines employed on the road. If a long train comes in that there is not room for on one track, part of that train can be put on another track, with the result that the tracks will be kept bunched up, as the switchman says, so as to economize in space, and quite often it is convenient not to make the ladders of each end of the yard parallel.

I believe in a distributing yard, that is, a classification or departure yard; also that a great advantage is to be found in making the ladders V-shaped, starting with the apex of the V at the main junction switch upon the tracks where the cars enter. Then make the other end of the V in the opposite way, which makes the central tracks the longest tracks, and makes the farthest distant tracks on the ladder the shortest tracks. This arrangement naturally converges the heaviest business and largest volume of business to the central tracks which are most conveniently reached, and the lightest business to the tracks furthest off. I think this will be found a convenient and economical arrangement.

All yards, whether at terminals or at division points ought to consist of two grand divisions, the receiving division and the departure division. In a great many old-fashioned yards, at least, the cars were received in the same yard where the trains had to be made up to leave. I do not know if anybody yet stopped to think who got up such a plan or what switchmen were to do in such cases, but it is obvious that such an arrangement makes a vast amount of rehandling of the business. If you have 20 tracks in the yard and 19 of them are filled and you start to switch a train that is on one of those 19 tracks, you have two empty tracks on which to construct a train which may have from 18 to 20 different kinds of business in it. It is a pretty simple proposition to say that you have to do a vast amount of rehandling to make up the train. I have seen switchmen that used a great deal more headwork than others in doing that sort of thing, but even the best man cannot make a job of switching such a train without a great deal of rehandling.

I should not build a big yard without a poling track, but after making very careful tests covering several months I came to the conclusion that poling did not pay unless there was a considerable volume of business; something over 300 or 400 cars to be handled by one engine in ten hours was about the limit. The reason for this is that with the poling engine we have to have from eight to 10 men, including the engineer and fireman, whereas with an ordinary engine you can get along with five men. Unless there is enough work to keep the poling engine busy, there is a wage account running against you which may offset the advantage of poling. In building poling yards, where the topography does not help out, I like the idea of putting considerable grade in the ladder and in the first start of the distributing yard, rather than to put it entirely in the poling track. I think the poling track itself can better be straight and the ladder track on a grade or incline than the other way around.

There is a great tendency always to work up to the limit of curvature. Now I want to advise anybody if he contemplates making sharp curves, not to try a 90-ft. radius. You will find a whole lot of cars that will not

*From a discussion before the Western Railway Club.

go around a 90-ft. radius curve. Take these great lumber cars on radii something like 150 ft. and the wheels are scoring into the sills and on a sharp curve you are likely to shove the car entirely off the track or skid the wheels while running. None of the powerful switch engines will pass around such curves and there are a great many reasons why they are objectionable.

I believe the one thing which would open the eyes of operating officers of railroads to the loss of time and loss of revenue by badly designed yards is handling cars on the per diem system. I mention that here, simply because I think it has an important bearing on the subject. The old system of paying for the use of cars on the mileage system is a good deal comparable to renting a house on the basis of the number of people that were going to occupy it. That would seem rather absurd, for, of course, the rent of the house is so much a day or so much a month or so much a year, but cars we rent at so much a mile and our neighbor can take our car and keep it for a month and if he keeps it on the side track we get nothing for the use of it.

Queen Meter-Spark Induction Coils.

The Japanese government, desiring to make extended experiments, selected the firm of Queen & Co., Inc., of Philadelphia, to construct for them two large induction coils which would give a spark length of one meter, or approximately 40 inches. Queen & Co. have heretofore made a specialty of coils giving 15-in., 18-in. and 25-in. sparks, but have never before attempted the construction of a coil with a spark length exceeding 25 inches. After considerable experimental work in order to determine the best form of construction and method of winding, the instrument, as illustrated in Fig. 1, was designed. It is thought that investigation of the claims of wireless telegraphy is the chief object of the order and that the instruments will be assigned to the navy. The results that will now be obtainable in wireless telegraphy experiments can only be conjectured, inasmuch as heretofore no such spark length has been available for use in connection with this work. It is thought, however, that owing to the peculiar nature of the long spark produced by these coils the distances that messages can be sent will be greatly increased.

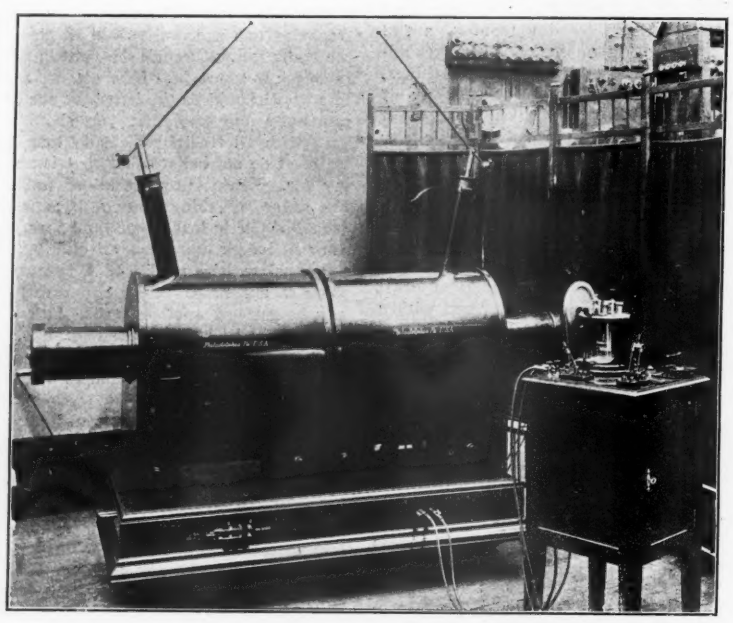


Fig. 1.—Meter-Spark Induction Coil—Queen & Co.

The induction coil is used for a wide variety of purposes, but during the past two or three years its importance has been greatly increased and its use considerably extended from the valuable effects it produces when used in connection with X-ray work and wireless telegraphy experiments. The coil itself is merely an instrument to convert a low voltage current into one of very high voltage. The length of spark depends upon the number of turns of wire on the secondary and upon this also depends the voltage. By the use of this instrument a current such as is given by storage battery can be transformed to such a high potential that sparks can be produced which will jump through several inches of air space. Owing to the great difficulty in properly insulating the wire in coils of long spark lengths, their construction becomes very difficult and the expense high. Coils have heretofore been considered large which would give a free spark through an air space of from 12 to 15 inches. This length of spark has heretofore been used for the best work in connection with X-rays and wireless telegraphy. It has been demonstrated, however, that upon the nature and length of the spark depends to a considerable extent the distances to which messages can be transmitted without wires. Figs. 2 and 3 give a fair idea of the volume and intensity of the spark from this instrument, as compared with results that are commonly obtained.

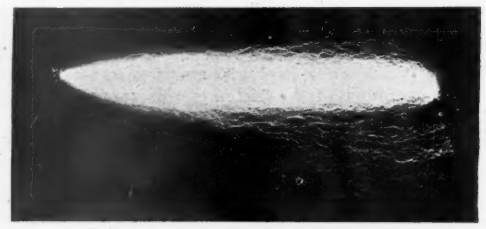


Fig. 3.—Induction Coil Spark at 32 in.

The finished instrument consists of two parts, the large sections representing the primary and secondary, and the smaller, cabinet at the side containing the switches, the improved break and condenser. The whole is mounted on casters so that it can be conveniently moved from place to place. Each secondary contains about 100 miles of very fine insulated copper wire wound in a great number of very small sections. The secondary, as may be seen from the illustration, is divided in the center, making two separate and distinct parts.

The primary contains considerable copper wire and over 200 lbs. of iron. In order to properly utilize the current which was necessary to operate these coils, a new form of break was devised which possesses many desirable features and which gives far better results than any heretofore secured. The speed at which this break operates can be made anything between one and several thousand per second. Inasmuch as at each break there is a spark induced in the secondary of the coil, it is evident that the speed at which the break runs determines the number of sparks produced by the secondary of the coil. When used in connection with a storage battery giving 25 volts and 20 amperes, a very heavy secondary spark, representing hundreds of thousands of volts, is produced between the terminals when they are separated 42 inches. This may be observed in Fig. 2. When used to give smaller spark lengths between 25 and 35 inches, and when the break is run at comparatively high speed, a great number of sparks will pass between the terminals. This manifestation appears in Fig. 3, which shows the spark points separated about 32 inches.

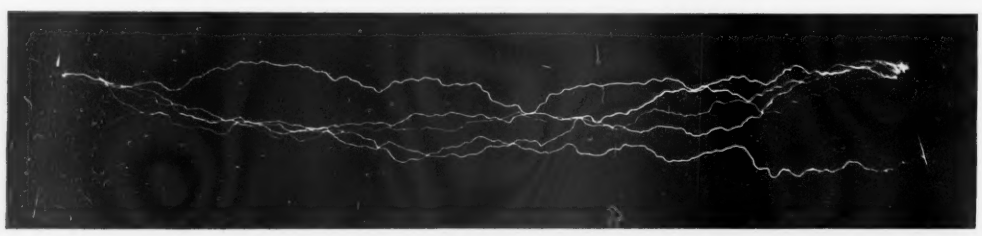


Fig. 2.—Spark of Queen & Co. Induction Coil at Separation of 42 in.

Draft Rigging.

Last week we published extracts from Mr. Sanderson's paper on draft gear tests at Topeka, Kan., and what follows is taken from the discussion of that paper before the Western Railway Club.

Mr. J. F. Deems (Chicago, Burlington & Quincy)—I do not recall what meeting it was, but in 1896 it was shown that at a certain important repair yard, running back through a series of years, the total number of cars passing that point in 1892, one car in every 200 went to the repair track on account of a failure of the draw-bar or draft rigging; in 1893, one car out of 220; in 1894, one car out of 263; in 1895, one car out of 545, and in 1896, one car out of 952, or showing there was a steady gain on that proposition. From year to year fewer cars were going to the repair track on account of draft rigging. At that time the 60,000-lbs. capacity car, with few exceptions, was the largest car in general service, and I presume it would be safe to say that 85 per cent. of those in service were 30,000 or 40,000-lbs. capacity cars. And not only that, but the tractive power of locomotives was much less, and the trains were much lighter. To-day the 80,000 or 100,000-lbs. capacity cars are quite common, and the 30,000-lbs. capacity car has well-nigh passed into history, so that the conditions have changed.

Some time ago, in order to collect definite information as to what parts of the cars were failing most frequently, arrangements were made to get a complete list of the failures for which cars were taken to the repair track, and it was found that out of a total number of 16,451 cars reported, the draft gear and couplers took 5,742 of them to the repair track, or 34 per cent. of the total. The couplers alone took 3,016, or 18 per cent. of the total; the draft rigging aside from the couplers included 2,726, or 16 per cent. of the total; while wheels came in with 1,713, or 10 per cent.; trucks 7 per cent. and so on down through some 83 or 84 different failures, some of them numbering only three or four. The failures of draft gear sent more cars to the repair tracks than the next four highest items. It would seem to indicate that we are not making the progress in that line that the figures quoted in 1896 seemed to show. While, as Mr. Sanderson says, the tests are by no means conclusive, they are certainly a starting point, and I hope that they will lead up to much more complete work along the same line, and that some tests will be made by the M. C. B. committee that we can consider conclusive. At least, some tests that will be conclusive at the time they are made. I do not know how long that will last.

Mr. E. M. Herr (Manager Westinghouse Air-Brake Co.)—I did not come here to discuss the draft gear question, and I do not know that I have anything special to say in regard to the draft gear in which the company with which I am connected is interested. I presume you all know that is the Westinghouse friction draft gear. The discussion of this draft gear is hardly pertinent in connection with Mr. Sanderson's paper, as his tests, if I understand the paper, were of the attachments to the sills and draft timbers. The Westinghouse friction draft gear, as you probably all know, is not an attachment, but, to put it perhaps as simply as possible, it is a substitute for the spring, with such modification and features of construction as practically take away the recoil of the springs and enormously increase its capacity. So the discussion of that particular draft gear is hardly pertinent to the paper, which is rather a means of attaching the draft appliances, namely, the coupler and the spring, to the car, than those appliances in themselves.

Mr. C. F. Street (Manager Dayton Malleable Iron Co.)—Three different types of rigging as manufactured by the Dayton Company were tested and reported in this test under G H and I; and subsequent to this a fourth rigging was tested. I have also had some draft rigging tests made. The first of these consisted of a service test in which we equipped two cars with draft riggings and loaded them to about 55,000 lbs. capacity, and drove them together at speeds ranging up to 16½ miles per hour. These cars were equipped with double spring draft rigging. Since that I have made three or four compression tests under ordinary testing machines, and since the writing of this paper have made another compression test. It is pretty hard to tell which of these tests give you the most information, and from my standpoint I think it is a good plan to make all of them.

The last rigging shown in this test, numbered I, was the Dayton draft rigging. This, as you see, went through the test with the bending of one follower ⅛ in. Since this test the same design was placed under a 100,000-lb. testing machine at Purdue University, and I have an outline report of the result of this test. The springs closed at 42,500 lbs. At 235,000 lbs. the spring at the coupler end failed. The spring had an uneven piece at the end, and this piece was driven into the solid malleable iron casting. The casting was not broken, it being merely crushed to a depth of about ¼ in. At 280,000 lbs. the first crack was heard; at 285,000 the second crack was heard; at 293,000 the third crack was heard. At 300,000 lbs. the draft rigging was not incapacitated for use. This was the full capacity of the testing machine. This load was brought on one draft rigging, or a straight compression test, as compared with the report in the paper with two draft riggings and drop tests.

Now, with regard to the testing of the draft rigging without the springs. This undoubtedly is a very good

test of malleable iron castings, but the conditions obtaining are so entirely different from anything in service that in my personal opinion it is a test which should not be made. Any manufacturer of draft rigging is perfectly ready and willing and only too glad to manufacture the strongest rigging that can be put on a car, but there are very few railroad companies that are ready to pay for it. The coupler situation, I think, illustrates that pretty thoroughly.

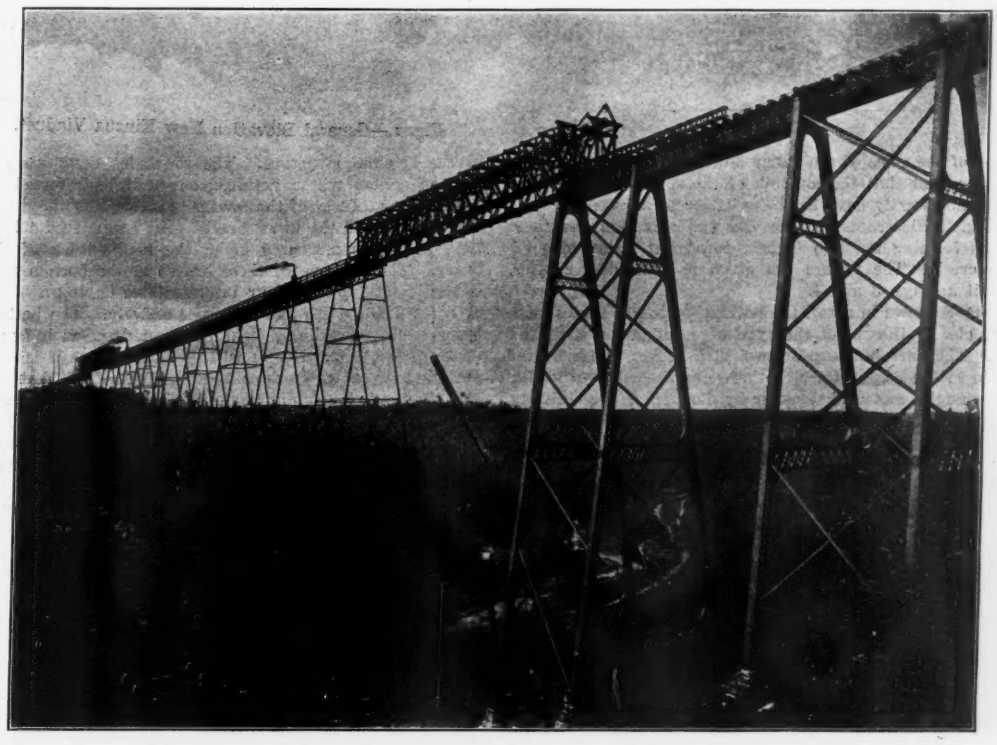
Mr. J. F. Deems—It is interesting to know if the lips turned on these straps in the tests were turned and put on the drawbar in the same manner that they usually are in the blacksmith shop, because I know from experience that in a blacksmith shop the lips do not touch the bar; that is, they do not touch the shoulders on the bar, and they cannot be of any great value in that shape.

Mr. C. F. Street—These lips when they were first brought up to the testing machine at Topeka stood away from the shoulder, but were carefully wedged in so that they had a solid bearing. Even after this was done the yoke turned back, and the yoke bent to the first rivet hole and turned up, the lip going away from the coupler and the rivet.

Mr. J. F. Deems—That is just the care they do not get in the ordinary work; they do not have wedges driven in to make up this solid bearing.

The Kinzua Viaduct.

One of the most notable examples of the advancement that has been made in the traffic requirements of the American railroad during the past 20 years is shown in the rebuilding of the Kinzua Viaduct on the Bradford Division of the Erie Railroad. At the time of its construction in 1882 this viaduct was one of the notable structures of the world, exceeding both in height and length anything of its kind that had, up to that time, been built. It was designed to carry the heaviest engines and cars that were in use and was admirably adapted to the purposes for which it was intended, this purpose being carrying the soft coal traffic of a section of Northwestern Pennsylvania to the connection of the Bradford Division with the main line of the Erie at Carrolton. But the increase of car capacity brought about by the introduction of the steel car coupled to the engines of enormous power that are now used to haul them, has added stresses that the structure was incapable of sustaining. The result has been that the viaduct built 18 years ago, and which had suffered no appreciable deterioration has been torn down to its foundations and a new one, capable of carrying modern traffic has been built.



Rebuilding the Kinzua Viaduct—New Structure on the Right; Old Structure on the Left.

Rebuilding the Kinzua Viaduct—The Two Old Middle Towers Still in Place.

In 1882 the consolidation locomotives used in the coal traffic weighed 103,400 lbs., of which 88,700 lbs. were on the driving wheels, 48 in. in diam., having a rigid wheel base of 14 ft. 9 in. and a total of 22 ft. 10 in. The boilers carried a pressure of 125 lbs. per sq. in. and the cylinders were 20 in. in diam. with a piston stroke of 24 in. The cars that these engines were hauling averaged a capacity of 40,000 lbs. with a leaven of a few of 50,000 lbs. capacity and with those of 60,000 lbs. just common enough not to excite undue attention. This traffic the viaduct has carried for many years; but the new conditions imposed are that cars of 100,000 lbs. capacity shall be run in trains hauled by engines of the consolidation type weighing 190,000 lbs., of which 170,000 lbs. is on the driving wheels of 57 and 64 in. in diam., with a rigid wheel base of 15 ft. 9 in. and 17 ft., and a total wheel base of 24 ft. and 25 ft. 3 in. The boilers carry a steam pressure of 200 lbs. per sq. in. and the cylinders are 21 in. in diam., with a piston stroke of 28 in.

Speaking roughly the car capacities have increased from 100 to 150 per cent., engine weights have gone up 83¾ per cent. and the cylinder capacity of the modern engine is 18 per cent. greater than that of the heaviest engines of two decades ago, so that in the combination of steam pressure and cylinder capacity the motive power has been increased between 75 and 80 per cent.

The importance of the structure as an example of engineering work will warrant a brief description of the original viaduct, a complete account of which, with details of construction was published in the *Railroad Gazette* on Dec. 15, 1882.

The height of the base of the rail above the water level of the stream in the bottom of the valley was and is 301 ft., and the total length of the viaduct is 2,053 ft. 1 in. The columns composing the towers of the original structure were of the Phœnix type and were built in sections 30 ft. long. When placed in position these sections were connected together by wrought iron sleeve joints placed inside the columns and firmly bolted, thus dispensing with the flanges generally used to fasten column sections together, and giving to the column, when finished, the appearance of a continuous post.

The whole structure was designed to withstand a maximum tension at the base of the highest windward column of 12,000 lbs. which was resisted by a pair of 1¼ in. round anchor bolts built into the masonry having a weight of 20 tons. This viaduct was capable of sustaining a moving load of consolidation engines, like those described above, covering it from end to end. It was erected in 1882 between the dates of May 10 and Aug. 29.

The increase in the weights of trains, as already intimated, has called for a stronger structure and about a year and a half ago it was decided to replace the old one, and the new viaduct was opened for traffic on Sept. 24, though there was still, at that time, some field riveting to be done as well as the guard rails, hand rails and sidewalks to be put in position.

The new structure was built under the regular Erie Railroad bridge specifications of 1900. The unit stresses were allowed to be increased 25 per cent. and the whole of the angles of the girder spans were counted as flange section. The webs were spliced for flange stress, but were not considered in the section. The wind load was taken as 30 lbs. per sq. ft. on the plate girder spans and train, and as 100 lbs. per vertical foot of bent. In addition to this the stresses in the unloaded structures were investigated under a wind load of 50 lbs. per sq. ft. on the girders and 160 lbs. per vertical ft. of bent.

Before entering upon the work of designing the new viaduct a careful examination was made of the old foundations and they were found to be ample, both in size and solidity, to carry the new viaduct. While the new columns required a larger footing than the old Phoenix construction the foundations had been made large enough to meet the new demands.

It will be seen by a reference to the half-tone reproduction of the photograph showing the viaduct in course of reconstruction, that there were six foundation piers for each tower. The four forming the outer corners of the rectangle carried the main columns, while the two at the center supported a vertical column used to carry the old cross bracing. In resurveying the line these central piers were used for the location of the center line. This center line was offset 1 ft. from the true line so as to clear the posts and give an unobstructed line of sight. At towers 6, 12 and 18 cross lines were marked at right angles to the center lines with stations up and down the valley, and these were used for the proper squaring of the towers on their foundations.

As will be seen from Fig. 1, which as a side elevation of the new viaduct in outline, the latter is formed of 20 towers, with intermediate spans of 61 ft., while the tower spans themselves are 38 ft. 6 in. long. There are also two end spans of 62 ft. ½ in. each.

In order to utilize the old foundations and at the same time maintain a constant batter for all of the columns, it was necessary to use the same batter that was employed on the original structure. Fig. 1 shows the sharp

A Traveller—Kinzua Viaduct.

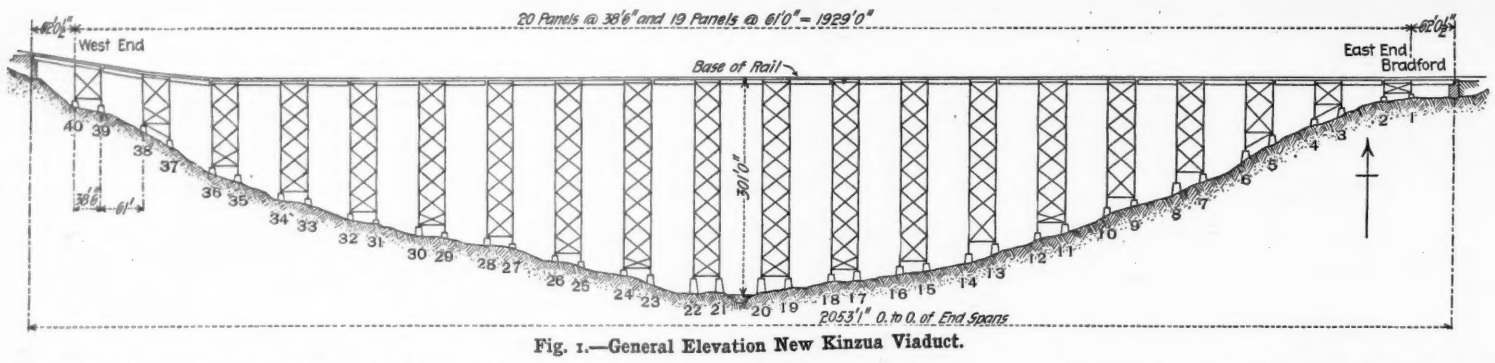


Fig. 1.—General Elevation New Kinzua Viaduct.

slope of the sides of the valley down to the creek, whence it is evident that the location of the several foundations must necessarily have fixed the batter to be used.

Fig. 2 illustrates in side and end elevation the four bents forming the two highest towers at either side of the creek. The towers are given in somewhat greater detail in Figs. 3 and 4.

Fig. 3 shows in detail the bottom section of the column and clearly illustrates the type of construction used for all. They are built up of two ½ in. cover plates 24 in. wide to the edges of which there are riveted two 6-in. x 4-in. angles and held together by diagonal lattice bracing formed of 5-in. x 3-in. angles.

Fig. 4 represents an end elevation of one of the bents on an enlarged scale and with the details more fully shown. At the foot the north leg is firmly bolted to the foundation by the two 1¼-in. foundation bolts that were used in the original structure. The south leg rests upon a nest of rollers whose arrangement will be referred to later. The stiffness of the towers is insured by the depth and strength of the sway braces that are spaced 62 ft. 10¼ in. apart measured along the inclined leg of the tower. There is one of these braces at the bottom and, in the highest towers, four intermediates having a depth of 8 ft., 7 ft., 6 ft., and 4 ft. respectively. The bottom brace seems exceedingly light in comparison as it has a depth of but 3 ft. But it will be noticed that it is supported at its center by the old central foundation that carried the vertical columns of the original structure. It was decided to utilize these foundations to carry these foot braces and thus save metal, although had the foundations been built for the present viaduct they would not have been put down.

The upper struts are formed of four 8-in. channels weighing 13¾ lbs. per foot set with their webs vertical. The diagonal bracing in the vertical plane is formed of 3 in. x 2½ in. angles and that in the horizontal plane by 4 in. x ⅜ bars, riveted to the webs and flanges of the channels respectively.

It is difficult to realize the stiffness added to the towers by these cross struts from any purely mathematical calculation. It is, however, very clearly demonstrated by a model in which the cross struts are light and flexible and which permit of excessive buckling of the columns when a cross stress is applied at the top; a buckling that entirely disappears under the same stress as soon as a stiffening action is applied to the struts. The brackets in the corners between the columns and the cross struts are built up of a web with connecting angles measuring 3 in. x 3 in. and an arch of 5 in. x 3 in.

The form of rollers used for carrying the east legs of

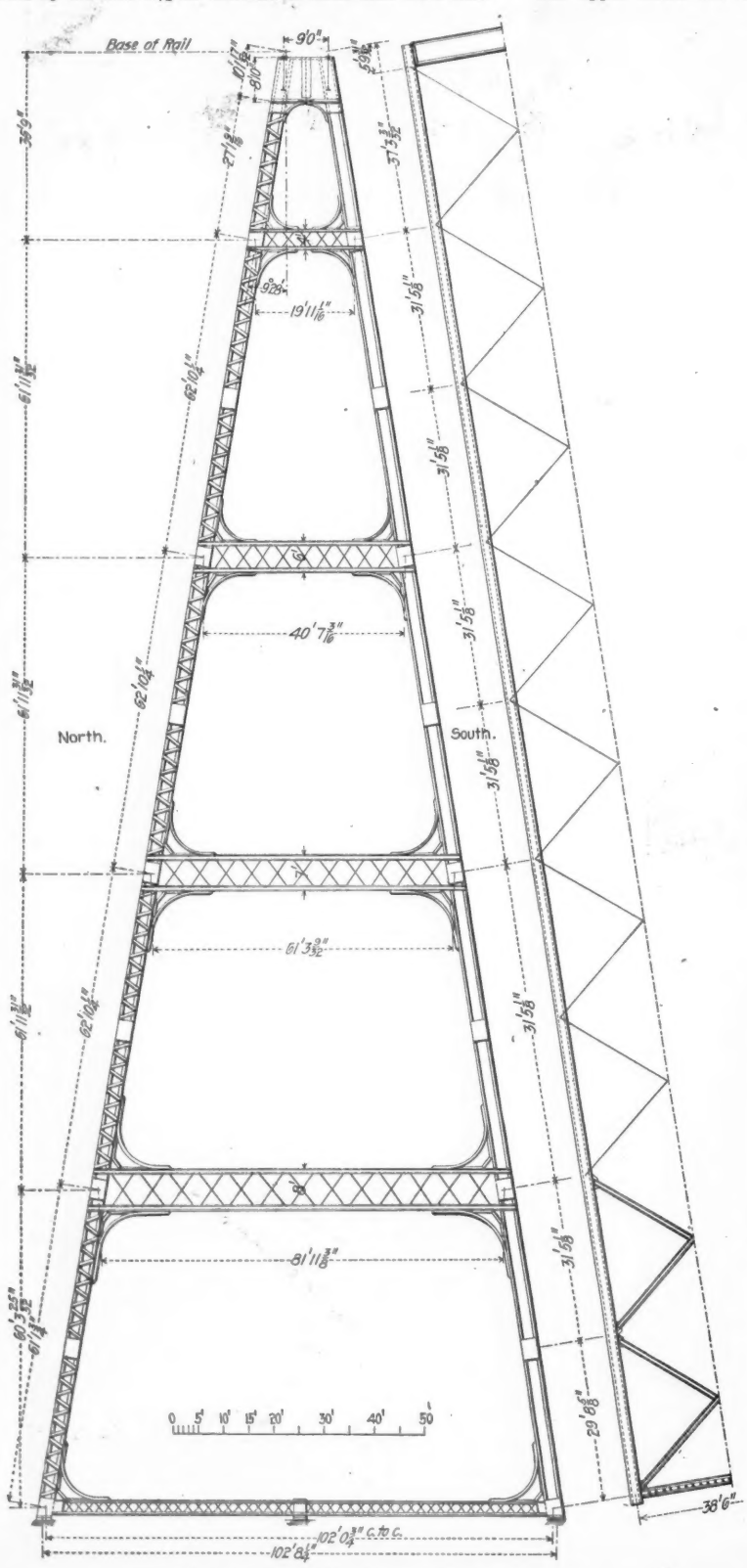


Fig. 2.—The Middle Towers, Bents 19 to 22.

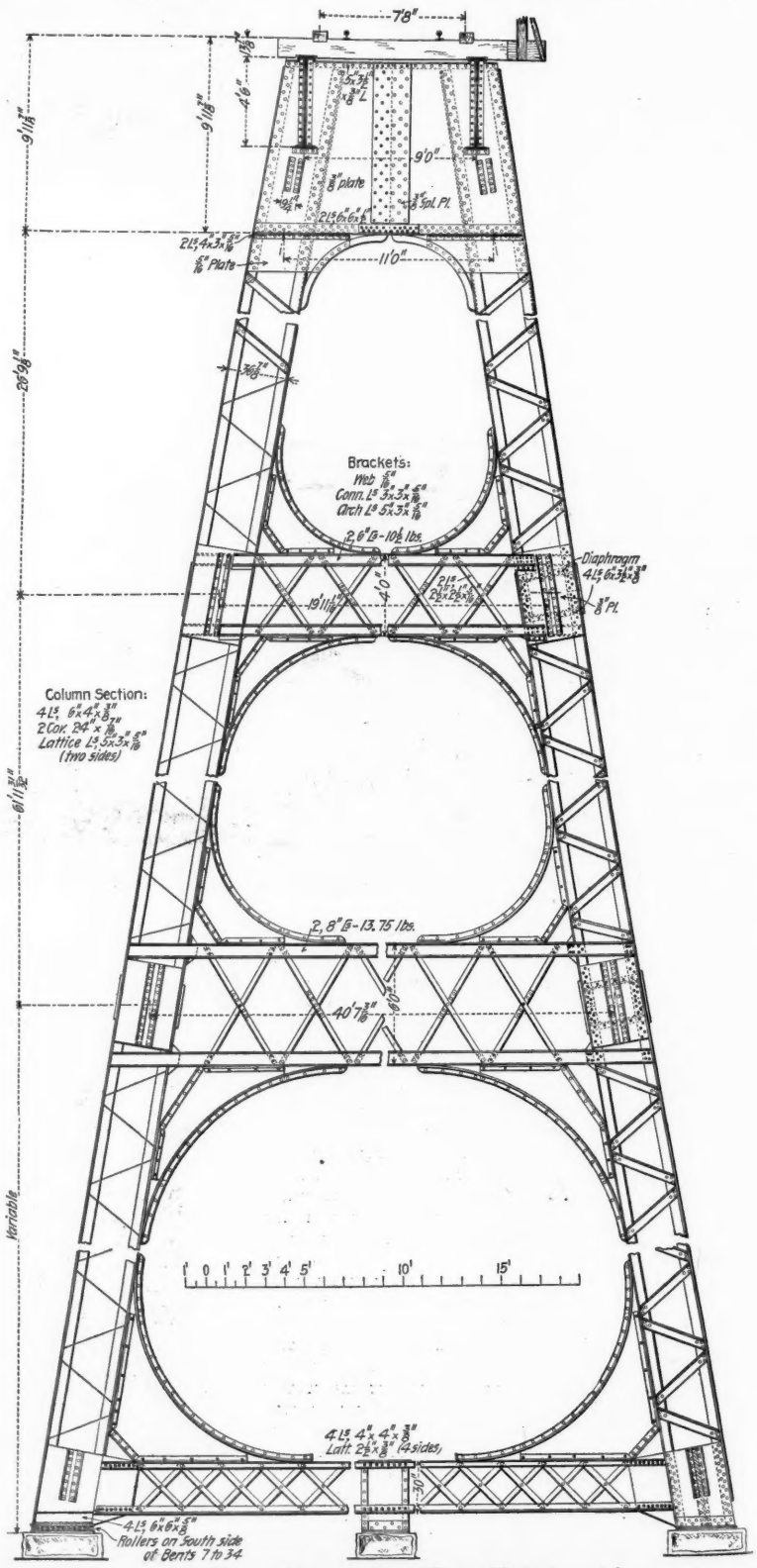


Fig. 4.—A Tower, New Kinzua Viaduct.

the towers is shown in Fig. 6. The next consists of four rollers 3 ft. ¾ in. long, 16, 1 ft. 3¾ in. long each, and four having a length of 3¾ in., all of a diameter of 3⅛ in. They are arranged in nests held by side plates and guided by a plate fastened to the bed plates that fit the grooves turned in the rollers. They are placed so that there is a free opening for the passage of the foundation bolts as shown to allow for the free movement of the foot under the influences of expansion and contraction.

The construction at the top of the towers is shown by Figs. 4 and 7. The former showing the girders in section and the latter in side elevation. The girders are of such depth as to have but one cover plate, thereby allowing the tie framing to be the same throughout and are formed of a central web ⅜ in. thick stiffened at both the top and bottom by two 6 in. x 6 in. by ⅝ in. angles with cover plates 9-16 in. thick, the main girders, while the tower girders have the same thickness and size of angles except that the latter are 7-16 in. thick and have cover plates ⅜ in. thick. Vertical angles measuring 4 in. x 3 in. x ⅜ in. are riveted outside the top and bottom angles with fillers ⅝ in. thick between them and the web to compensate for the thickness of the angles.

The diagonal bracing of the girders consists of 3 in. x 3 in. x ⅜ in. angles, for the tower girders, and 3½ in. x 3½ in. x ½ in. for the intermediate spans. The cross frames are shown in Fig. 8. The diagonals are of 3 in. x 3 in. x ⅜ in. angles and the horizontals of 3½ in. x 2½ in. x ⅜ in. angles, of which there are two at the top and bottom.

The tower girders are riveted at each end to the vertical angles at the tops. The longitudinal expansion of the main girders is provided for by the use of rollers held in a bracket as shown in Fig. 7.

The diagonal longitudinal bracing of the towers is clearly shown in Fig. 7 and is formed of 8-in. channels riveted together at the center by means of ⅜-in. tie-plates and held at the ends by ⅜-in. gussets that are themselves riveted to the towers by means of two 5-in. x 3-in. x ⅜-in. angles. At each such connection point there are two stiffening angle diaphragms in the column. The ties are laid directly upon the upper cover plates of the girders and the rails are spiked to them. Outside the rails there is a footpath protected by a substantial handrail.

In profile the surface of the bridge is level from the east end out to bent No. 36, forming the west side of tower No. 18, from which point there is a sharp rise to the west abutment.

In the erection of the new viaduct the problem was a comparatively simple one, though requiring the exercise of great care from the start to finish. Owing to the height at which a large portion of the work had to be done it was decided to be quite out of the question to carry on traffic while the work was progressing. Accordingly trains were sent around on a detour over the tracks of the Buffalo, Rochester & Pittsburgh Railroad, and there was nothing to impede the rapid and continuous execution of the work.

The method employed was as simple as it was effective. Two wooden travelers built with Howe trusses were used. The general form of their construction may be clearly seen in the half-tone engraving in which they are shown in position and at work. The length of these travelers was such that they could rest on two towers and spanning the space between them be used for the demolition and erection of an intermediate third. Each was supplied with an efficient hoisting engine, and was fitted with an overhead track upon which two lorries traveled, that were used for handling the material. At the ends there were also jib cranes that were available for loading and unloading materials from the cars.

The method of procedure was to work outward from each end. The outer end of the traveler was run out upon the second tower from the abutments and the girders and first tower removed. The new tower was then put into position and the girder running to the stone abutment placed. The traveler was then moved out, so that its shore end rested upon the new tower while the outer end was carried by the third tower from the end, when the second tower and third girder were removed. When the

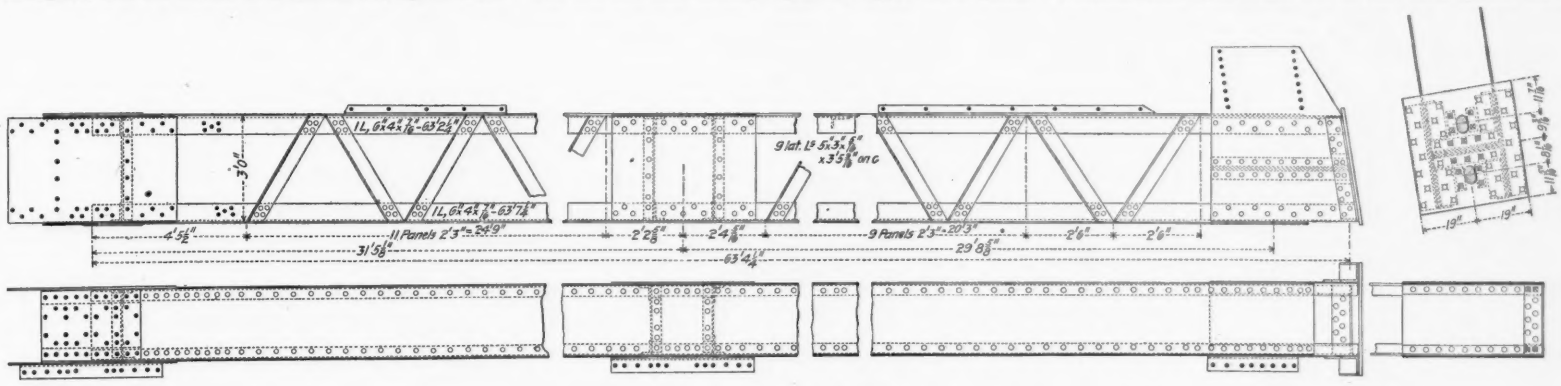
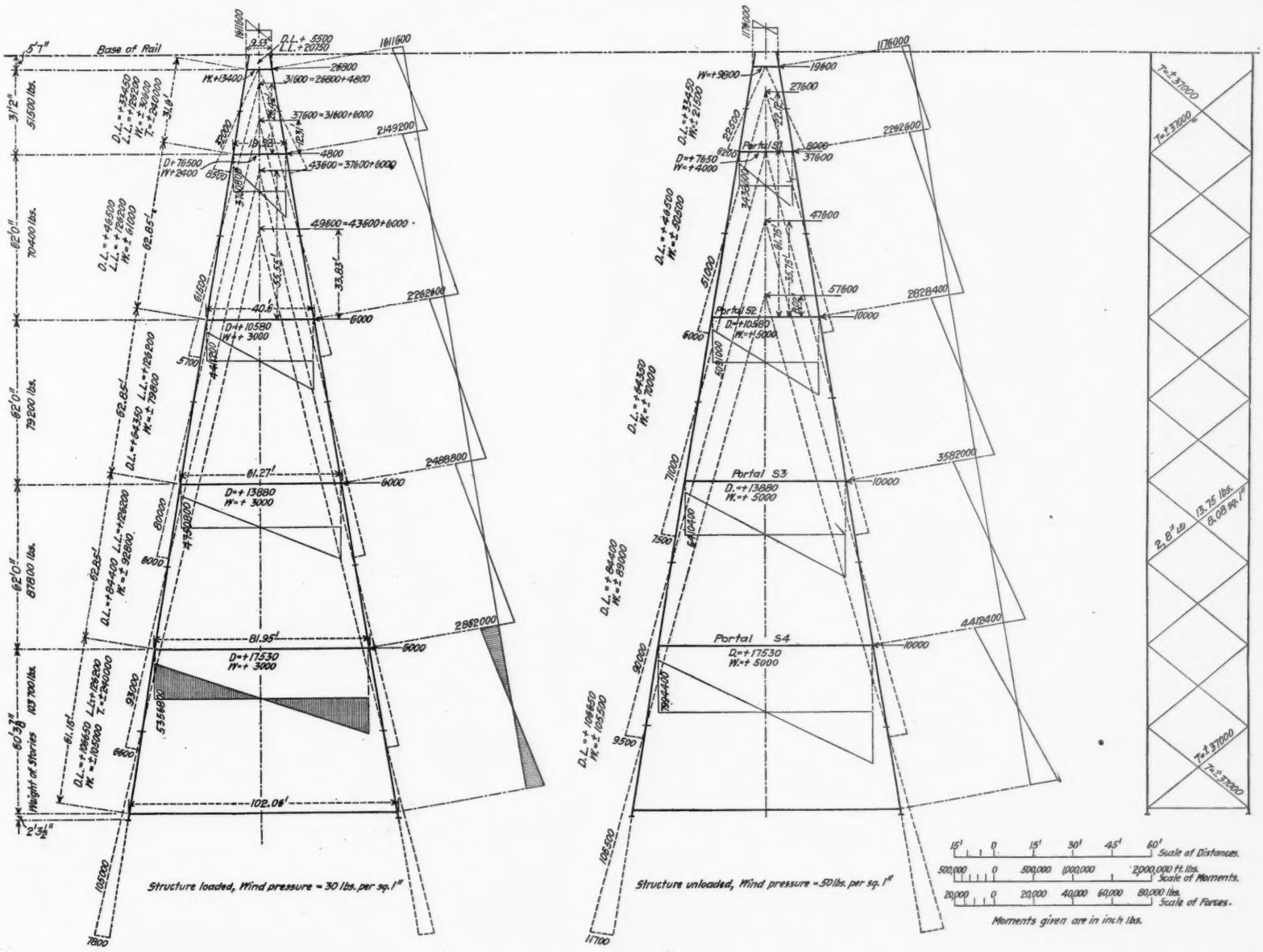


Fig. 3.—Detail of Bottom Column Sections, Bents 19 to 22.


Base of Rail
Portal S1
Portal S2
Portal S3
Portal S4
Structure loaded, Wind pressure = 30 lbs. per sq. ft.
Structure unloaded, Wind pressure = 50 lbs. per sq. ft.
Scale of Distances.
Scale of Moments.
Scale of Forces.
Moments given are in inch lbs.

Stress Sheet for a 285-foot Tower—Kinzua Viaduct.

The computation of stresses from the braking of trains assumes the point of contraflexure at half the height of the towers.

The computation of wind stresses assumes the point of contraflexure at the middle of the column sections, portals and headers.

second tower and the girder leading to it had been placed the traveler was moved on to the next and so on. This was continued until the two travelers met at the center.

When this had been accomplished there was a gap between the central towers and the adjoining ones on either side. The travelers were not, however, designed to sustain their own weight under cantilever stresses while being moved over one of these openings. In order to meet this contingency two of the old girders were sent to the shop and cut off so as to fit the space between the old central tower and one of the new towers adjacent thereto. When these were put in position one of the travelers was backed off and removed from the structure, while the other was run ahead and used for the demolition and re-erection of the last tower.

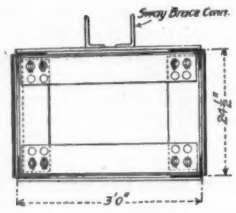


Fig. 5.—Detail of a Diaphragm.

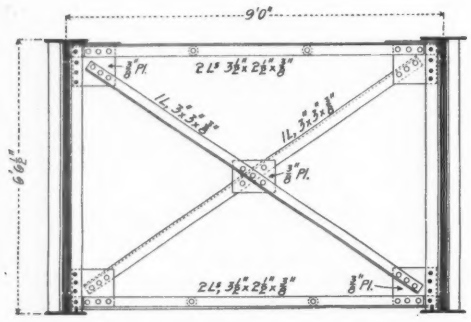


Fig. 8.—A Cross Frame of Main Girder.

In the execution of this work the girders were lifted out of their position and, on being run back were loaded on flat cars and hauled away. The towers were merely thrown to the ground. They were not tipped bodily over, but, owing to the peculiarity of the construction of the columns, it was an easy matter to lift off section after section and as soon as each was clear of its fellow below, to drop it to the ground. This method served to very materially expedite the work, but strewed the ground beneath with the debris of the old structure. After the new work had been put into place a derrick car was run out upon the tracks and the old material hoisted to the top and loaded upon the cars for removal.

This method entirely avoided the use of falsework by making the old structure serve that purpose. Scaffolding was, of course, used for the riveters, but this was hung from the new work as it progressed. Comparatively little field riveting was done, and was limited to the placing of the tie plates and the uniting of cross braces with the columns, the fastening of girders and similar work that could not possibly be done in the shop.

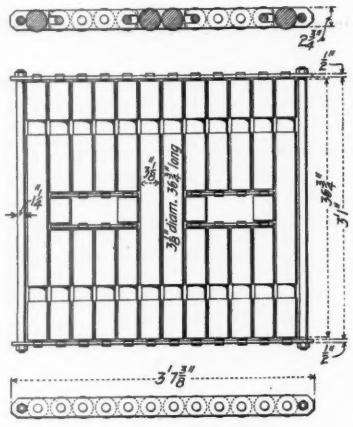


Fig. 6.—A Set of Rollers.

The erection of the towers was carefully watched and their truly vertical alignment secured by observations made at a distance up and down the valley from stations at right angles to the center line of the viaduct. During the whole of the work of erection there were no accidents and so carefully and thoroughly had the surveys been made that no errors crept in and no changes were found to be needed in any of the work as it came from the shop.

The reader will already have grasped the fact that existing conditions controlled the design pretty closely in some particulars, and we need not go farther into that aspect of the work. The type of the new structure was determined by and the work was executed under the direction of Mr. C. W. Buchholz, Chief Engineer of the Erie Railroad Co., whose assistant, Mr. M. R. Strong, Bridge Engineer, was in immediate charge of the work. The resident engineer representing the railroad, and by whom the surveys were made was Mr. F. A. Howard. The contractor for the metal work was the Elmira Bridge Co., by whom the detailed plans were made. These plans were submitted for approval in pencil form in accordance with the usual practice of Mr. Buchholz' office.

The stresses are limited by the bridge specifications already referred to as follows:

Shearing stress for rivets and bolts	6,000
Bearing stress for rivets and bolts and members connected thereto	12,000
Shearing stress for pins	7,500
Bending stress for pins	15,000
Shearing stress for web plates	4,000
Pressure on masonry	250
Pressure per lineal inch on rollers	300 lbs. X diameter

For other members of the structure the permissible working stress per square inch of section was determined by the following formulæ:

For pieces subjected to one kind of stress only (all compression or all tension):

$$8{,}000 \text{ lbs. } \left(1 + \frac{\text{min. stress in member}}{\text{max. stress in member}}\right).$$

For pieces subject to stresses in opposite directions:

$$8{,}000 \text{ lbs. } \left(1 - \frac{\text{max. stress of lesser kind}}{2.\ \text{max. stress of greater kind}}\right).$$

The new viaduct therefore, stands ready to carry the modern train load with an ample factor of safety to allow for such increase of weight of load as the future may bring forth. It stands in sharp contrast, in the substantial character of its appearance, to the slight and slender framework of its predecessor as prominently set forth by the engravings showing it in course of erection, and it will be a curious commentary upon modern foresight if this, too, should become a thing of the past within a quarter of a century, because the then traffic offered shall have exceeded the limits of its strength just as the loads which it is intended to carry would be too much for the sustaining power of the original viaduct.

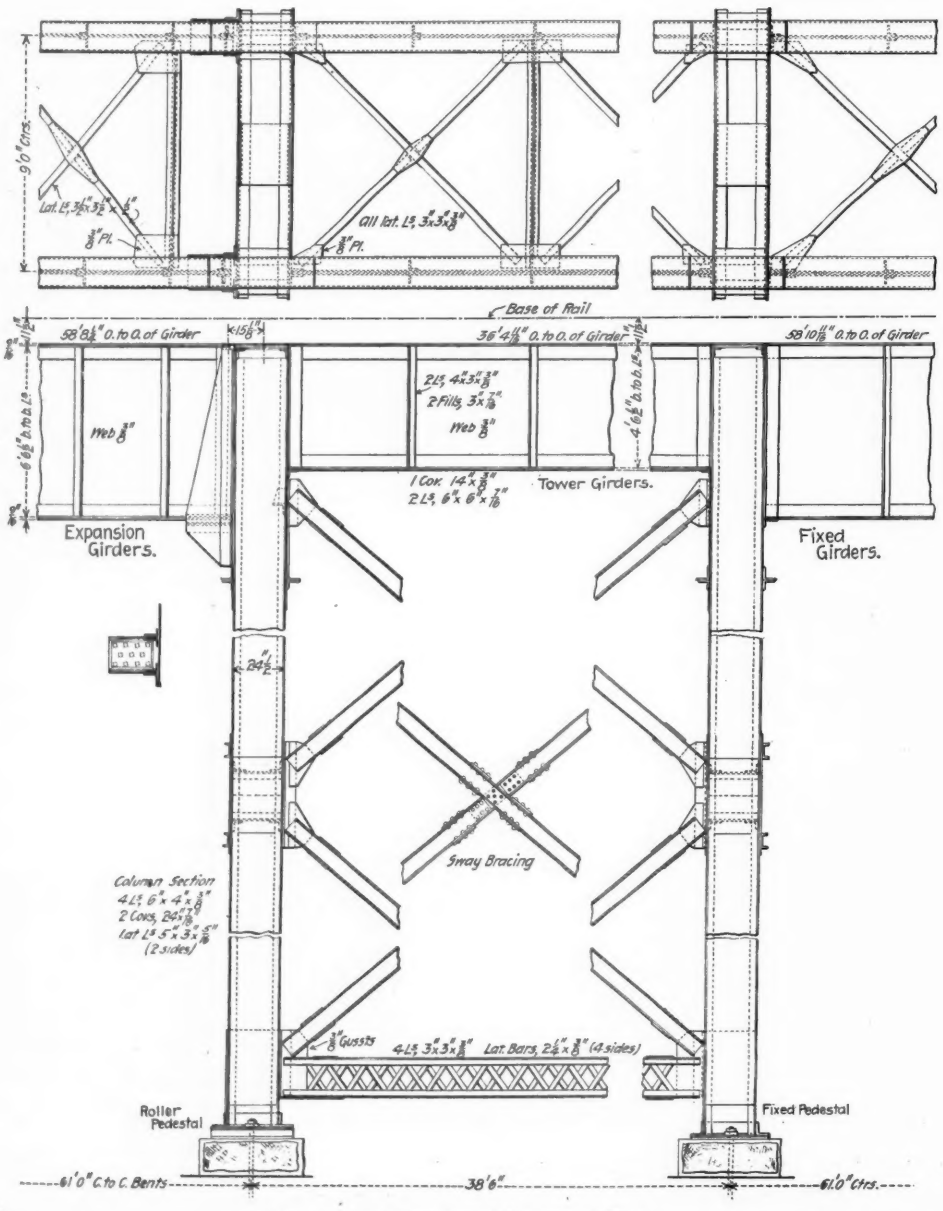

9'0" Ctrs.
Lat. Ls 3½" x 3½" x ½"
⅜" Pl.
All lat. Ls 3" x 3" x ⅜"
⅜" Pl.
Base of Rail
58'8¼" C. to C. of Girder
15⅛"
36'4½" C. to C. of Girder
58'10⅛" C. to C. of Girder
6'6½" C. to C.
Web ⅜"
2 Ls 4" x 3" x ⅜"
2 Fills 3" x ⅜"
Web ⅜"
1 Cov. 14" x ⅜"
2 Ls 6" x 6" x ⅞"
Tower Girders.
Expansion Girders.
Fixed Girders.
24½"
Sway Bracing
Column Section
4 Ls 6" x 4" x ⅜"
2 Covs. 24" x ⅜"
Lat Ls 5" x 3½" x ⅜" (2 sides)
⅜" Gussets
4 Ls 3" x 3" x ⅜" Lat. Bars, 2½" x ⅜" (4 sides)
Roller Pedestal
Fixed Pedestal
61'0" C. to C. Bents
38'6"
61'0" Ctrs.

Fig. 7.—Side Elevation of Tower and Plan.

New 100,000-lb. Hopper Bottom Coal Cars—Norfolk & Western Railway.

The Norfolk & Western will shortly build some new hopper bottom coal cars of 100,000 lbs. capacity at the Roanoke shops, which will differ somewhat from those now in use and shown in our issue of July 28, 1899. The principal change is in substituting steel truss side framing for wooden stakes and stake pockets, the frames being similar to those used with the 80,000-lb. gondola cars illustrated June 15 last. With some minor changes, it is expected to make a hopper car weighing about 37,500 lbs., or about 2,000 lbs. less than the weight of the present hopper bottom coal cars of the Norfolk & Western.

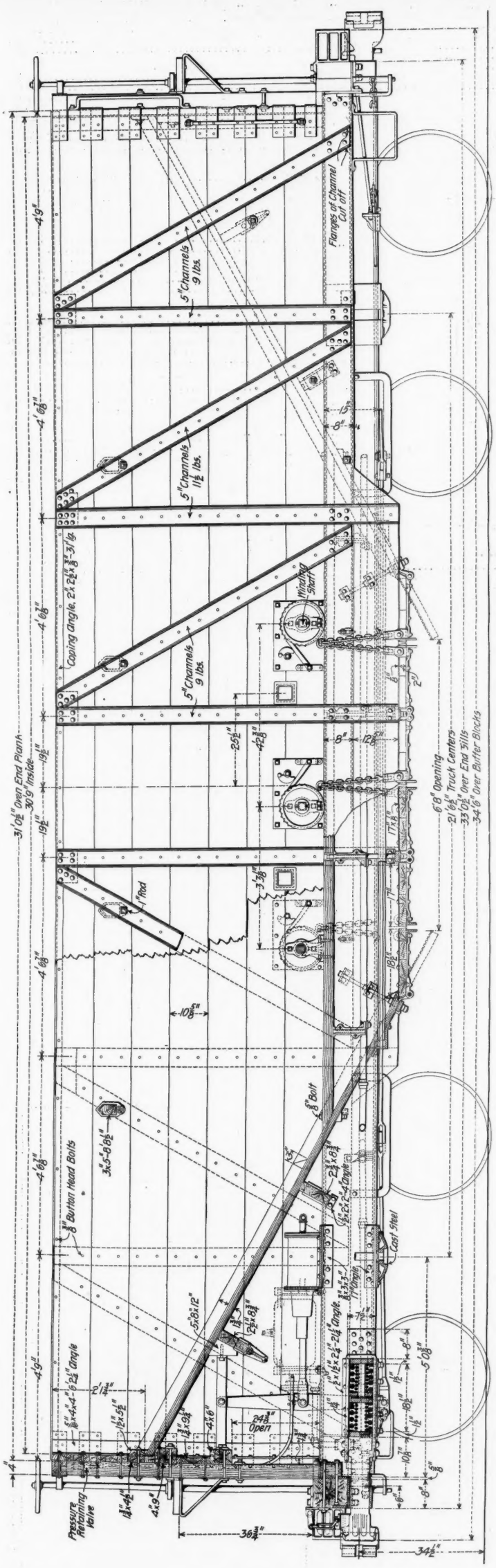
The length of the new cars over end sills is 33 ft. ½ in., over buffer blocks 34 ft. 6 in., and the length inside is 30 ft. 9 in. The inside width is 8 ft. 9½ in., and the width over sides is 9 ft. 2 in. The distance from the bottom of the hopper to the top of the sides is 7 ft. 11 in.

Referring to the engravings, it will be seen that this car, in addition to the metal side frames, has a steel underframe consisting of two 15-in. 33-lb. channels for center sills and side sills of 8-in., 11¼ lb. channels. In the former design, all the sills were 15 in. deep. The longitudinal sills are joined to ⅝-in. end plates by vertical angles, and diagonal angle braces extend from the ends of the center sills to the body bolsters. These bolsters consist of steel plates and malleable iron fillers riveted in such a way as to secure the necessary rigidity with light weight, being similar to the bolsters of the 80,000-lb. cars. The center plates are cast steel. The side sills are tied together by a rod back of each body bolster.

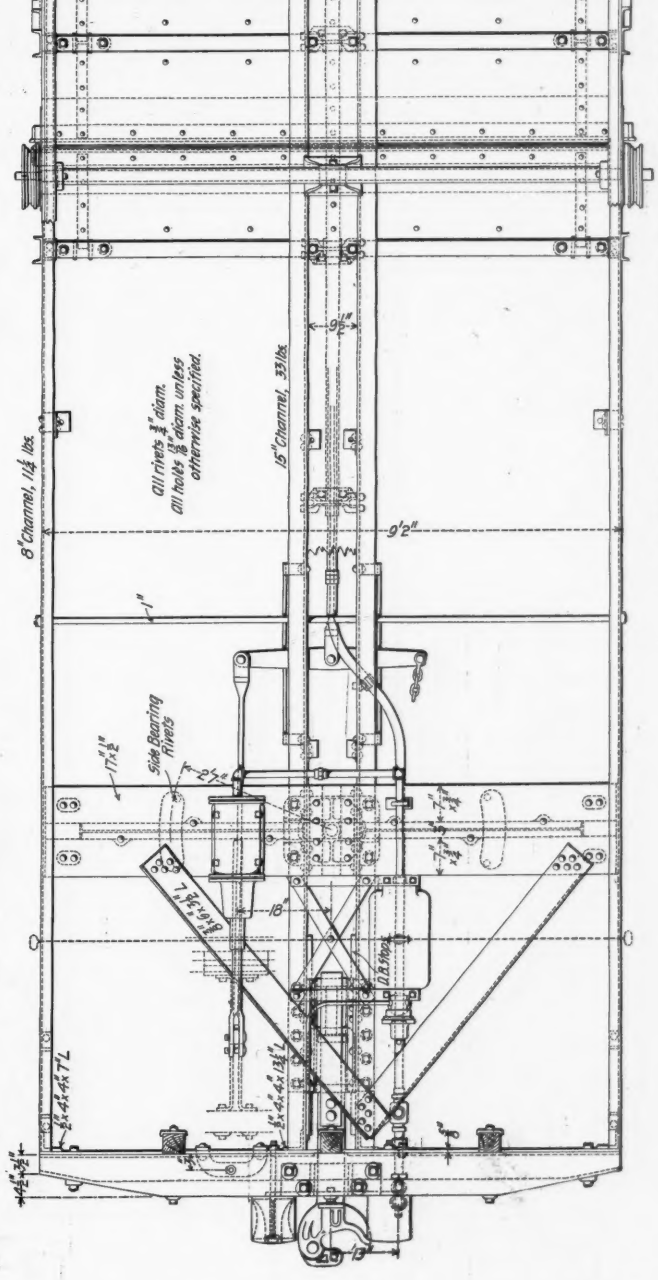
The side trusses are formed of 5-in. channels with riveted plate connections. There is a 2 x 2½ x ⅜-in. coping angle at the top, and at the bottom, the truss members are riveted directly to the webs of the side sills. There are three 4 x 4 in. wooden posts at either end. Three sets of hopper doors are used, giving a discharge opening of 6 ft. 8 in. All chains for handling the doors are on the outside and the doors can be operated from either side of the car, the chain sheaves being mounted on heavy shafts extending across the car. These shafts are protected by 2½-in. pipes which also serve as cross-ties for the hopper. The cross pieces to which the doors are attached also assist as bottom ties. The top ties are 1-in. rods with wooden thrust timbers, all protected by angle irons. The hopper side boards are 2¼ in., the end boards 1¾ in. and the hopper bottoms are 1¾ in. thick. In the first hopper cars, heavier planks were used for the sides and ends.

The draft gear acts directly on the center sills and tandem springs are used, so arranged that both sets of springs act together in pulling and buffing. The standard diamond frame truck of the road, having a steel bolster, will be used under these cars.

We are indebted to Mr. W. H. Lewis, Superintendent of Motive Power for drawings and information.



Section.



100,000 lbs. Capacity Hopper Bottom Gondola Car With Steel Framing—Norfolk & Western Railway.

Brooks "Chautauqua" Type Passenger Locomotives—Burlington, Cedar Rapids & Northern.

Three passenger locomotives, designated as the Chautauqua type, and having the general characteristics of the Atlantic type have been built by the Brooks Locomotive Works for the Burlington, Cedar Rapids & Northern Railroad. The illustrations are from a photograph of engine No. 77, and drawings of elevations and sections, sent by the builders.

It may be seen from the illustrations that the boiler is of the Player-Belpaire wagon top type; that the fire-box is wide and sloping forward above a low section of plate engine frames in which the 51-in. trailing wheels are journaled radialiy; and that the pedestal jaws for this pair of wheels are bolted to the plate frames. The rockers are double armed as usual and are placed between the main frames of the engine. Ten-inch piston valves are used, having inside admission. The extreme travel is given as 4¼ in. with steam lap 1 in., and the exhaust side, line and line.

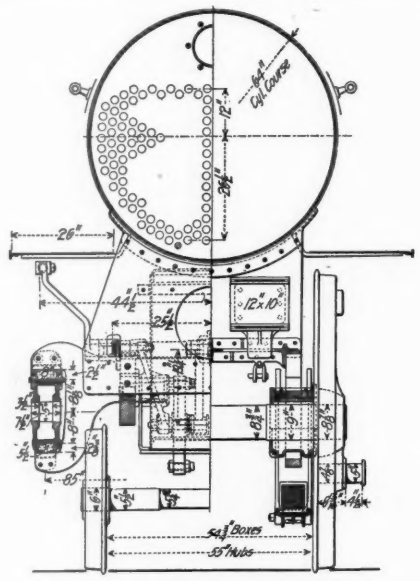
The lead in full gear is 3-32 of an inch, and at 6-in. cut-off it is ¼ in. in the go ahead motion, the running cut-off being favored by setting the valves 3-32 in. blind in full gear in the backup motion. Port and exhaust opening, with other information on these points, will be found in the list of general specifications. It is noticeable from the illustrations that the cylinders and steam chest are liberally provided with relief and safety valves in accord with the quite common belief that these accessories are necessary where piston valves are used. General dimensions, weights, and detailed information are given in the following descriptive specifications:

DESCRIPTIVE SPECIFICATIONS.

Type	"Chautauqua"
Gage	4 ft. 8½ in.
Kind of fuel	Bituminous coal
Weight on drivers	88,000 lbs.
" truck	35,600 lbs.
" trailer	35,000 lbs.
" total	158,600 lbs.
" tender, loaded	107,000 lbs.

General Dimensions.

Wheel base, total of engine	27 ft. 0 in.
" driving	6 ft. 9 in.
Wheel base, rear driver to trailer	9 ft. 5 in.
" total, engine and tender	52 ft. 11¼ in.
Length over all, engine	38 ft. 11½ in.
" " total, engine and tender	63 ft. 4½ in.
Height, center of boiler above rails	9 ft. 2½ in.
Height of stack above rails	14 ft. 11 in.
Heating surface, fire-box	155.8 sq. ft.
" " tubes	2396. sq. ft.
" " total	2551.8 sq. ft.
Grate area	45.32 sq. ft.
Surface of grate	40.7 sq. ft.



B., C. R. & N.—"Chautauqua" Type.

Wheels and Journals.

Drivers	Four
" diameter	75 in.
" material of center	Cast steel
Truck wheels, diameter	36 in.
Trailing wheels, diameter	51 in.
Journals, driving axle	9 in. x 12 in.
" truck "	5½ in. x 12 in.
" trailing "	8 in. x 14 in.
Main crank pin, size	6½ in. x 6½ in.
" coupling "	7 in. x 4½ in.
" diameter, wheel fit	7⅞ in.
Trailing axle, type	Radial

Cylinders.

Cylinder, diameter	19½ in.
Piston stroke	26 in.
" rod, diameter	3⅝ in.
Main rod, length center to center	124½ in.
Steam ports, length	22 in.
" " width	1⅞ in.
Exhaust ports, least area	75 sq. in.
Bridge, width	2⅜ in.

Valves.

Valves, kind of	10-in. piston, inside admiss.
" greatest travel	4¼ in.
" steam lap (inside)	1 in.
" exhaust, lap or clearance (outside)	Line and line

Valve Motion, Forward Gear.

Lead, full gear	+3-32 in.
" 6-in. cut off	¼ in.
Port opening 6-in. cut off	5-16 in.
Pre-admission 6-in. cut off	13-16 in.
Exhaust opens 6-in. cut off	At 17½ in.
Cut off full gear	21½ in.

Valve Motion, Backward Gear.

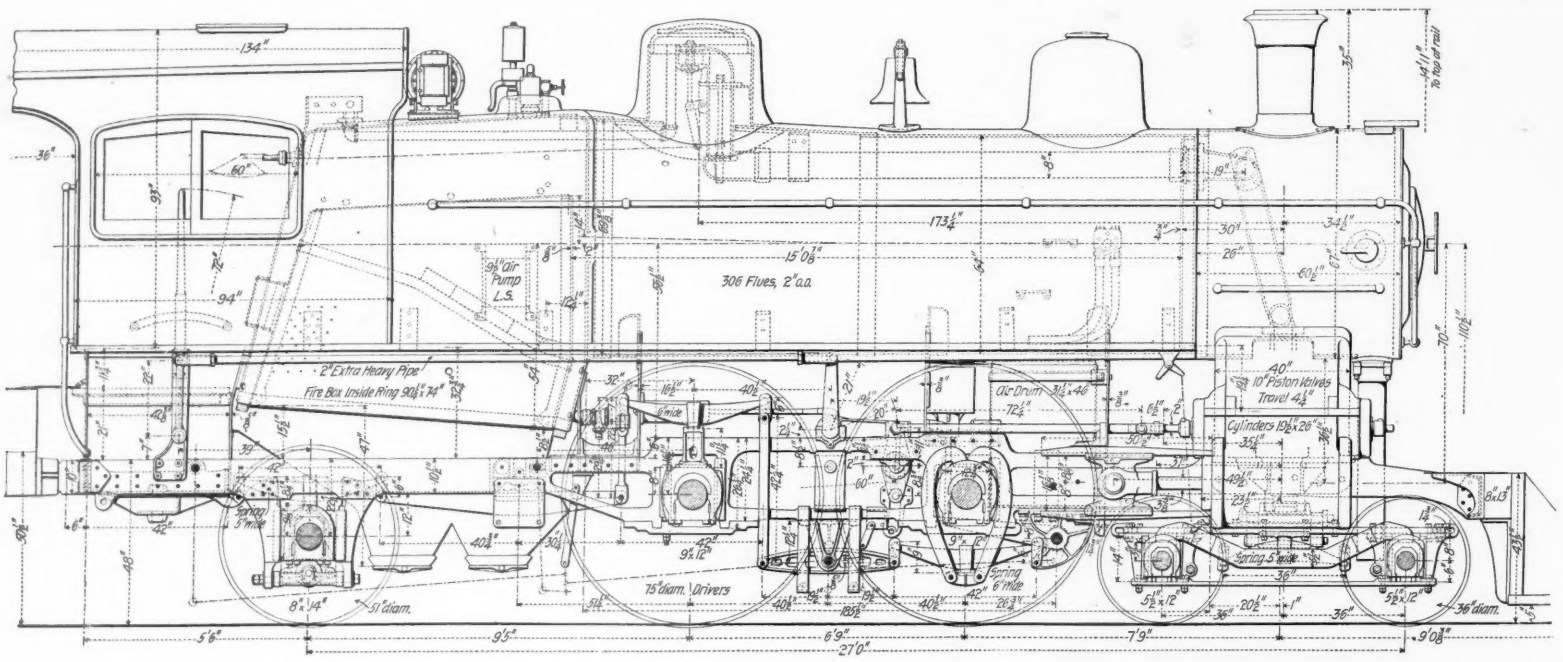
Lead, full gear	—3-32 in.
" 8-in. cut off	+3-16 in.
Port opening 8-in. cut off	5-16 in.
Exhaust opens, 8-in. cut off	At 18¾ in.
Cut off, full gear	21½ in.

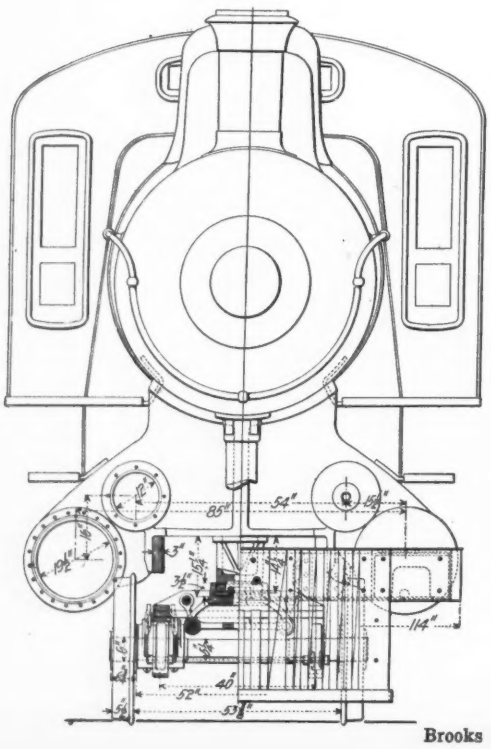
Boiler.

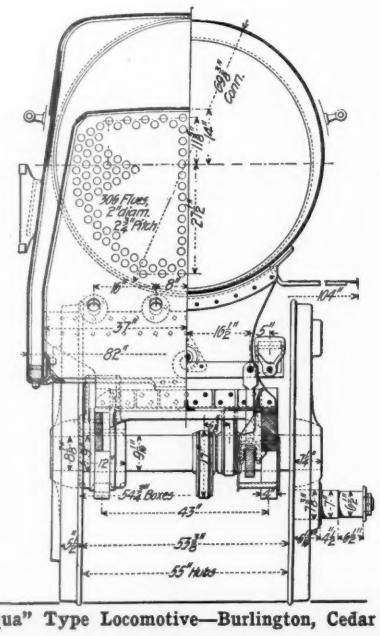
Boiler, type of	Player-Belpaire, wagon top
" working steam pressure	210 lbs.
" material in shell	Steel
" thickness of material in shell,	⅝ in., 11-16 in., 9-16 in., and ½ in.
" " " front tube sheet	¾ in.
" diameter of shell front	64 in.
" " " " at throat	69⅜ in.
" " at back head	64 in.
Seams, kind of horizontal	Sextuple butt and quintuple lap
" " circumferential	Double and triple lap
Crown sheet stayed with	Direct stays
Dome, diameter	30 in.

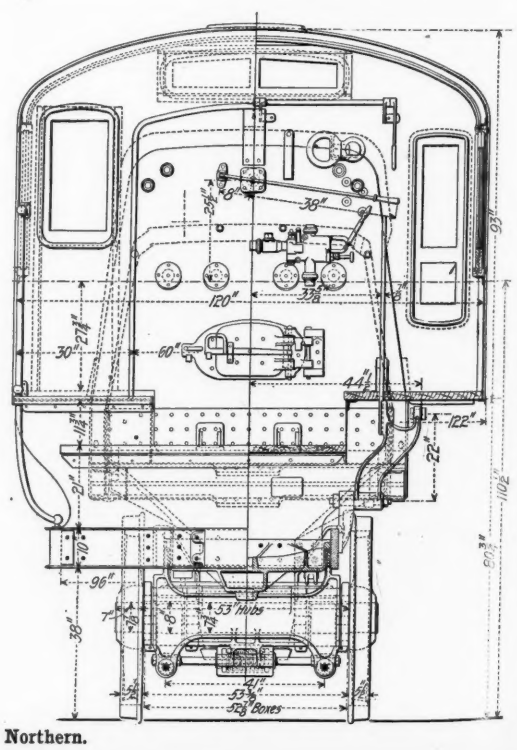
Fire-Box.

Fire-box, type	Long, sloping over trail wheels
" length	90¼ in.
" width	74 in.
" depth front	68 in.
" " back	57 in.
" material	Steel
" thickness of sheets	Crown ⅜ in., tube ⅝ in.
" " "	Sides and back ⅜ in.









Brooks "Chautauqua" Type Locomotive—Burlington, Cedar Rapids & Northern.

Fire-box, brick arch	On 4 water tubes
" mud ring width, back	3½ in.
" " " sides	3½ in.
" " " front	4 in.
" water space at top, back	7 in.
" " " sides	5 in.
" " " front	4 in.
Grates, kind of	Rocking
Tubes, number of	306
" pitch	2¾ in.
" material	Iron, No. 11 B. W. G.
" outside diameter	2 in.
" length over tube sheets	15 ft. 0⅞ in

Smoke-Box.

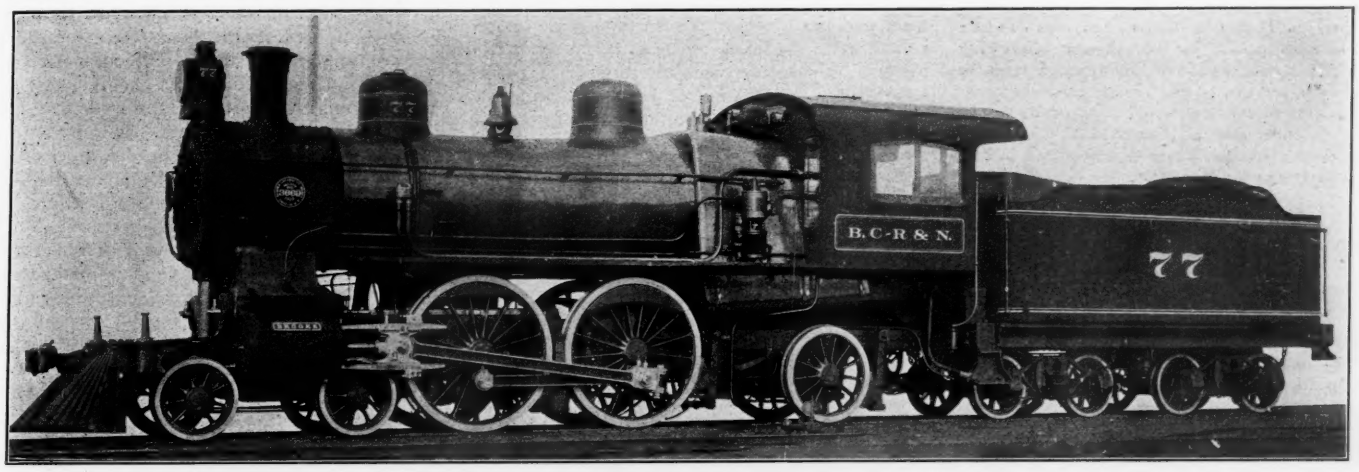
Smoke-box, diameter, outside	67 in.
" length from flue sheet	58½ in.

Other Parts.

Exhaust nozzle	Single
" " area	17.7 sq. in.
Netting	Wire
" size of mesh	2½ x 2½
Stack	Taper
" least diameter	15⅝ in.
" greatest "	17⅛ in.
" height above smoke-box	35 in.

Tender.

Type	8-wheel, steel frame
Tank, type	Slope top
" capacity, for water	5,000 gals.
" " " coal	10 tons
" material	Steel
" thickness of sheets	¼ in.
Type of under frame	10-in. steel channel
" " truck	B. L. W. 100,000 lbs.
" " springs	Double elliptic
Diameter of wheel	36-in.
" and length of journal	5 in. x 9 in.
Distance between centers of journals	76 in.
Diameter of wheel fit on axle	6⅝ in.
" " center of axle	5⅝ in.
Length of tender over bumper beams	21 ft. 1½ in.
" " tank	19 ft. 6 in.
Width of tank	10 ft. 0 in.
Height of tank, not including collar	5 ft. 0 in.
Type of draw gear	M. C. B., Tower



Brooks "Chautauqua" Type Locomotive—Burlington, Cedar Rapids & Northern.

Special Equipment.

Brakes	Westinghouse automatic
"	American equalized, on back of all drivers
Pump	9½ in.
Sight feed lubricator	Nathan
Safety valves	Crosby
Injectors	One No. 9 Metropolitan, one No. 9 Ohio
Springs	French
Metallic packing, piston rods	Jerome
" " valve stems	B. L. W. Special
Headlight	Pyle Electric

Electric Traction Equipment of the Manhattan Elevated—New York City.

The Manhattan Railway Company, New York, made its first public test of an electrically equipped train on Thursday of last week, between 65th street and 92d street, on the Second Avenue Line. The train, of four coaches and two motor cars, one of the latter being at each end of the train, made several successful round trips between the points named, the speed at times reaching 35 miles an hour. Acceleration was all that could be desired and control was good. The control of motors is one of the important features, and is Mr. Baker's arrangement, and the practical knowledge of Mr. Baker, who designed the Intramural Railroad of the Chicago Fair, and was General Manager of the Metropolitan Elevated when that system of electric traction was being installed, has, of course, been of great use in determining matters on the Manhattan. The power used in the tests of this first electric train is taken from the Metropolitan Street Railway Company's 66th street power house, on what was formerly known as the Third Avenue Line.

The electric power house of the Manhattan Elevated is now being built at 74th to 75th streets and East River, and its four brick chimneys have already become a land-mark. It is expected that the building will be finished within three months. The building is of granite, brick and steel; one deep story, with galleries and the required sub-spaces, the total floor space being 86,204 sq. ft., a clearer idea of the extent of which is given by comparison with the floor space of Madison Square Garden in New York, 83,937 sq. ft. The boiler plant will have 32,000 boiler h.p., and the steam engines will develop 64,000 I. H.P., these figures being close approximates. There will be eight Westinghouse generators of 5,000 K. W. each. The initial voltage on conductors leaving the power station will be 12,000 and it will be transmitted to the several lines through seven sub-stations which divide the system into substantially 13 equal divisions. The voltage delivered to motors will be 500. The immensity of the power demand becomes apparent when it is remembered that there are nearly 40 miles of double track, which with third track gives 109 miles of single track, on which six-car trains will move at one-minute intervals during heavy traffic hours. The main conductors, at leaving the central power station, will be triple "Clover Leaf" cables.

The track equipment is of the third-rail, copper-bonded, shoe-contact type, 60-ft. rails of 100-lb. section, being mounted on vitrified clay insulators for the third rail line. The track work was begun on Second avenue, and there are now about five miles of the third rail installed. The work on tracks will be completed first on the Second avenue line and then on Third, Sixth and Ninth avenue lines, in the order named, thus working westward across town. The railroad company is doing all of its track and car work.

The coaches will undergo no material change in construction. The trial train has New York "straight air" brakes; Gold electric heaters, 18 in each car, and Van Dorn couplers and draft gear attachments, drawing on the truck center pin as usual in elevated service. The type of air-brake that will finally be used has not yet been determined. Whatever the system of braking may finally be, air will be compressed by a double cylinder air pump, that has a single discharge-chamber, common to both pump cylinders, and is driven by an independent electric motor of about three horse-power. It is said that a new system of air braking recently perfected by the Standard Air-Brake Company, 168 Broadway, New York, will presently be tried on the test train. With this brake it is claimed to be possible to make a service application, intensify it to emergency, reduce the braking force to any effective pressure above zero, and reintensify the braking force to any desired degree, without having released the brakes at any time during the operation. The advantage of all this is apparent in considering the requirements of elevated work. Electric light will be provided, and no gas used.

The motor cars have steel underframes of 8-in. I-beams and but one platform on each motor car is enclosed for motorman and controller; the controlling mechanism is on one end of the car only. Two motor cars will always be used, one at each end of the train, even though but two cars should run in a train. This point will be mentioned later. Six cars will be the maximum train, and it is unlikely that less than three cars will ever be in a train. The coaches weigh 29,000 lbs., empty. The motor cars weigh 66,000 lbs. each, and the maximum live load is 14,000 lbs. per car, thus raising the total weight per motor car to 80,000 lbs., or 20,000 lbs. adhesive weight on each of four axles, each axle being driven by one 125-h.p. motor, geared, nominally, to a maximum speed of 28 miles an hour. The wheels are steel-tired, 33 in. diameter. The coaches seat 48 people; the motor cars, 44.

A most interesting feature of the equipment is the simple and effective control of all motors in a train, by the movement of the reverse lever at either end of the train. The controllers are General Electric L-13. From the make-up of trains, previously given, it is seen that one of these controllers heads the equipment, in either direction. Assume, for example, a train headed south, Harlem to City Hall. The motors at the rear of six cars, or of any other number of cars, are connected with the motors at the head end by a trunk wire that runs under each coach, and is coupled by special contacts between them, below the car platforms. The reverse lever moves in a horizontal plane on top of the controller, and is locked in position by a circular quadrant and latch-ring of clever design, the latch-ring being a concentric circle in the quadrant.

The distinctive feature of control is that no current is used for reversing the motors of the rear car, except just at the moment of contact of points on the reverse lever, with special contact pieces set in the head of the controller. In the passing of the reverse lever to the go-ahead position on the forward car, for example, the contacts for reversal of the rear motors are made and passed, the entire rear electrical equipment is automatically set for movement in the desired direction, and remains so until the forward motors are reversed. This effects a pronounced economy and advantage, as no current is used to hold motors in reversal. The controlling devices are quite similar to those used on the Central London (underground) from Shepherd's Bush to the Bank of England, except that this automatic and positive reversal of following motors is not used there. The arrangement, in total, may be best described as a series parallel equipment.

In determining what form of equipment should be used, economy of power and safety from arcing, car fires and passenger alarms, have at no time been lost sight of. The arrangement of controllers, as described, puts the entire apparatus in the cab with the motorman. In case of accident, it is almost as fully removed from passengers as would be true of a locomotive hauling a passenger train on a surface road. Everything that requires special care or attention is within sight of the motorman and is easily accessible.

No fuses are used to guard against short circuit, automatic circuit breakers being used instead. Rheostats are placed relatively low under the motor car, and therefore further from the car body, with additional chances in favor of keeping them cool. There is no electrical apparatus in the coaches that can cause concern to passengers. A question often asked may here be answered, namely, no provision is made to guard against lightning as the steel structure itself is the best "ground" that could be desired.

The general idea of operation is this: During heavy traffic hours six-car trains will be run at an average speed of 15 miles an hour, including all stops. The present schedule time from Harlem to the Battery will probably be reduced from 10 to 15 minutes without taxing the central power plant beyond its most economical rate of production. The value of this operation may be more apparent when reference is made to an attempt to shorten the schedule on the South Side Elevated Railroad of Chicago, about seven years ago. At that time the writer made acceleration tests that showed the maximum speed attainable between stations, separated a distance of four city blocks, to be 31.2 miles an hour, for a very short period, midway between the stations. This was with compound steam engines, and was good work with five loaded cars to be handled in the distance given. The total length of track from Congress street station to Jackson Park station at the Exposition grounds was 8.6 miles. About the time of the opening of the Exposition it was thought advisable to shorten the schedule of 30 minutes for the single trip, including all stops, to 25 minutes total time. Hard coal was burned in the locomotives, and it was found, within a week, that to take the five minutes from the schedule of 30 minutes cost an outlay in coal that was prohibitive, and the schedule was immediately restored to 30 minutes. As may be apparent from the following paragraph, with the volume of traffic that is to be cared for in New York, it will be possible by a sliding scale of schedules and trainloads to closely adapt the power demand to the greatest efficiency rate of the central power station throughout the day.

Bearing upon power load of the central station, assume a loaded train of six cars, and a distance of 1,775 ft. from station to station, as representing the line load, for a total average speed of 15 miles an hour, when this train is to be accelerated from a state of rest to a maximum speed of 35 miles an hour, at the rate of two miles per hour, per second, and to be braked to a stop, in 14 seconds, at an average rate of speed reduction equal to the rate of acceleration. When the lighter traffic hours are being worked, trains of three cars will be run on a quicker schedule, the average speed from end to end of the line being 17 miles an hour, and thus be made to approximate the first-named duty. It is clear that within these figures, or other figures which may grow out of experience, there may be made an economical adaptation of load to power-total at all times. This must result, in great measure, in equalizing the load of the power station; in a corresponding economy in cost of power transmission; in a greater return of interest on the original investment, both for rolling stock and power plant; and in the rendering of a greatly bettered public service.

Efficiency tests are now being made from which it will probably be possible to publish further information with descriptions of salient features of the work in detail. Locomotive engineers now employed on the Manhattan road will be given opportunity to qualify as motormen, and, meeting the requirements, will be put in charge of motor cars as the change progresses.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Railroad net earnings for September, according to the *Chronicle* show a slight loss, although there was a gain in gross. The figures cover 134 roads and the total net earnings were $35,039,210 for September this year, against $35,753,668 in 1899, a falling off of 2 per cent. The gross earnings on the same roads were $99,405,329 in September, 1900, against $97,079,946 last year, a gain of 2.4 per cent. The heaviest percentage of losses of any group of roads was the seven anthracite coal roads, which showed a loss in net earnings of $822,279 or 30.28 per cent. This was due, of course, to the coal strike which began the 17th of September. Another group showing losses was the Northwestern of 11 roads, amounting to $226,052 or 4.1 per cent. This loss is accounted for chiefly in the failure of the spring wheat crop. The 13 Pacific coast roads reported a falling off of $549,129 in the net earnings, or 7.29 per cent. It should be noted that these losses followed very heavy gains of both gross and net in 1899, which were for the entire number of roads reported 12¼ million dollars and nearly 4½ million dollars respectively. There were 22 roads out of the total that show increases, and 27 that show decreases in the net earnings amounting to more than 30,000. The leaders in the increases were the Pennsylvania system, East and West, with $289,500; the Atchison, Topeka & Santa Fe, $214,513, and the Chesapeake & Ohio, $169,403. The largest decreases were shown by the Lehigh Valley (including the Lehigh Valley Coal Co.), $491,881; the Northern Pacific, $326,465, and the Erie, $189,102.

In this country, custom has prescribed that the type of a locomotive is determined by the arrangement of the supporting wheels, but as things are now going we shall soon have to alter the meaning of this term and make it less precise. This is to be regretted as giving new names to familiar types of engines is bound to result in a useless confusion of terms. The type of engine which is now going through the renaming process has four coupled drivers, a four-wheel leading truck and a pair of trailing wheels. This is all the description needed to determine the type, which wheel arrangement in 1895 was called the "Atlantic." A pamphlet recently issued shows a variety of Atlantic type engines with simple and compound cylinders, wide fire-boxes and narrow fire-boxes, and until this year the name has answered all purposes and has been generally accepted. Now we have two other names, the "Northwestern" and the "Chautauqua," for this identical wheel arrangement. It may be urged that in the Northwestern type a wide fire-box is used with the cab at the rear, and that the trailing axle has outside bearings. In the same way the Chautauqua type has a radial trailing truck which may be held to warrant a new name. But it is probably unnecessary to remind our readers that by definition these details have nothing to do with determining the type of a locomotive. While it is useful to have a specific name for new wheel arrangements, this renaming of old types must appear petty to technical men, and reflects credit on no one. In fact, so far as our observation goes, that is just the way they consider it. Of course the object is perfectly transparent to everyone.

Electrifying the Manhattan Elevated.

At this moment several things of uncommon interest in transportation are going on in New York City. The financial interests are so great, the volume of work to be done is so large, the convenience of so many people is involved, that the results will be watched with uncommon interest.

The first of these matters that we shall consider, perhaps the one of greatest immediate importance, is the electrifying of the Manhattan Elevated Railway. Something of this is discussed on another page. There are certain obvious advantages to follow from this. The adhesive weight can be spread over more wheels than with a steam locomotive, and from this will follow quicker acceleration, higher maximum speed, if that is wanted, and even without higher maximum speed better average speed from start to stop. A higher mean speed is desirable, no doubt. It is one means of conserving human energy by reducing the time spent in unproductive travel. It broadens the zone available for residence, but it is not of such immediate importance as adding to the number of cars in the average train, for this at once increases the number of passengers handled in a unit of time, or permits the same number to be carried with more comfort. This result also will be brought about when it becomes possible to use more adhesive weight.

The ability to despatch passengers from any given point will also be increased by the fact that the trains may be got away at shorter intervals as there will be no shifting of locomotives at the terminals. Certain minor advantages will follow; particles of coal will not be blown out of smokestacks into the street; there will be no smoke and no steam, and no noise of exhaust, although so far as mere noise goes we question if there will be any important gain. The nuisance of these minor matters has been greatly exaggerated, but it is worth something to get rid of them.

As a result of all these improvements there will be better accommodation of the public, a better feeling towards the road and a growth of business. The number of passengers carried by the Manhattan Elevated in recent years has fallen materially below the maximum reached in 1893, as will be seen by the following table:

1887	158,963,000	1894	202,752,000
1888	171,530,000	1895	187,615,000
1889	179,497,000	1896	184,704,000
1890	185,834,000	1897	182,965,000
1891	196,714,000	1898	183,361,000
1892	213,693,000	1899	174,325,000
1893	221,407,000	1900	183,789,000

We may reasonably expect that within a short time of the establishment of electric working the number of passengers carried will again reach the maximum of 1893 and many elements of operating expenses will not increase with the increased movement of passengers. The greater amount collected in fares will be largely net gain.

We have never believed that the public of New York will find the electric working of the Elevated any safer than working by steam, or that the public will find electric working as much more agreeable as is generally expected. Indeed, we have often said that the operation of the Elevated has for years been one of the finest examples of transportation that the world has ever seen. The company has carried 3,348 million passengers and has never yet killed a passenger in an accident to a train. Passengers have been killed by their own fault or the fault of other passengers, but never in a train accident. And this work has been done at better average speed than has been maintained in any other great city and with astonishing regularity and punctuality. To-day a man in Harlem may arrange business appointments in Wall street and keep them to a minute. A man on any part of the island may safely estimate within five minutes the time which he allows to catch an outgoing train at any of the stations or ferries. The public of New York does not appreciate how well it has been served; but no doubt it will soon be better served in frequency, volume of accommodation and probably somewhat better in speed.

Whether or not the operating cost will be reduced enough to pay interest on the cost of the change is yet to be seen. We have never supposed that it would be, but venture no prediction, and those who have studied the matter most deeply are confident that interest will be saved and something over.

The mechanical problems that confront the engineers of the Manhattan are, in some ways, unprecedented. The amount of current to be sent out from the power house is greater than has ever been delivered from any one source in the world. We are not now speaking of the nominal horse-power of the engine plant, but of the amount of electric current that must actually be sent out over the line, and this we repeat will be greater than has ever been sent out from any one point in the world. This current must be distributed over 100 miles of track, or about 87 miles excluding sidings, and obviously these extraordinary conditions have brought new problems. The train equipment will be novel in that a motor car will run at each end of the train, the intermediate cars having no motors. This introduces some original methods of control, and, furthermore, the controllers will have more capacity than any ever before used in traction.

Draft Gear and Couplers for Heavy Service.

Two weeks ago we published a letter from Mr. George Westinghouse on draft gear and couplers for heavy service, and also an editorial article on the same subject. Below are extracts from a few letters which we have received giving various shades of opinion on the subject.

Those who have read carefully Mr. Westinghouse's short letter or who will now turn back and read it carefully, will observe that several of our correspondents seem to have missed the real point made by Mr. Westinghouse, which may be summed up in three propositions: First, the railroads need a better draft gear (of course including the coupler); second, they need uniform draft gear; third, the time is now opportune to choose a standard. He appeals to the owners and to the highest officers of railroads to put in motion the machinery for supplying these needs, and obviously he would expect the selection to be made through the mechanical departments.

Confirmation of what is said about the need for better draft gear for pulling and buffing comes, in one form or another, almost every week, and last week we printed, page 774, a paper by Mr. Sanderson on some tests of draft gear which gives still further confirmation if it were needed. These trials were designed to test the attachments to the sills for pulling shocks, it being assumed that if they would stand these they would stand the buffing shocks. It should be kept carefully in mind that they were only partially tests of draft gear. We shall not now attempt any discussion of the results of these tests, but it will be seen that all of the rigging began to fail early in the game.

Our point now is that Mr. Sanderson confirms all that has been said as to the need of doing something to save not only the draft gear but the underframe from the destructive shocks of heavy service. He says "designs that for years have given good service and were, by the best authorities, looked upon as the most advanced practice, have failed utterly and miserably to meet modern service. The expense for maintenance of draft gears is becoming daily a larger factor in the total cost of car repairs and something must be done to meet and better the conditions. . . . Having reached the conclusion that in modern train service the train shocks were of such momentum as to be quite beyond the power of any reasonable springs to absorb (and assuming these had spring capacity to do this the recoil would itself cause break-in-twos) the malleable iron dead block becomes a necessity to protect the couplers. . . . It resulted that the tests most suitable for the occasion were jerk tests or such as would correspond to the forces at work in freight trains that tear out the draft gears."

The matter is now well under way. The Master Car Builders' Association is likely to make a pretty careful investigation of the subject of draft gears, having an able committee appointed to report on that subject, which committee has authority to hire an expert to conduct the tests. We understand that it is proposed to make these tests quite thorough and complete; to ascertain whether spring draft gears can be so modified as to be safe on heavy equipment; to ascertain what effect the recoil has in increased shocks; also to test the Westinghouse and the Sessions friction gears with a view to finding out the best device on the market for application to cars of large capacity. Probably the investigation will not be allowed to drop out of sight or to sink into a merely perfunctory and routine matter. It seems likely that directors, presidents and general managers understand that the economical results of such an investigation justify a considerable expenditure of time and energy by the mechanical departments. We have long regarded this as one of the great works to be pushed along by those departments as were the study of the air-brake and the coupler.

The paragraphs which follow are from the officers

of some of the largest railroad companies in the country, and they give the opinion of some of the highest officers connected with those companies. Unfortunately, we are not at liberty to give names and places.

There can of course be no question as to the desirability of a standard coupler of approved character for heavy freight service, and which would be uniform for all roads using such equipment. I think matters are shaping themselves somewhat in this direction.

The proposition of Mr. Westinghouse would be a very excellent one if it could be carried out, and if it can be determined which is the best draft rigging and coupler, and if either or both are what are required to meet the present conditions of service, and the conditions which are likely to prevail for the next fifteen or twenty years. . . It will be necessary to adopt a friction draft gear, as it will probably be found that to introduce sufficient spring capacity to take care of the shocks will result disastrously on account of the tremendous recoil under certain conditions. The most promising device known at present is the Westinghouse draft gear. Any device of sufficient capacity to take care of the shocks will undoubtedly require as much space to attach it to the car as is required by the Westinghouse draft gear. It would therefore seem wise, if the railroads of the country are not prepared to accept the Westinghouse draft gear, to at least arrange the draft timbers, or sills, and the appliances for conecting the draft rigging to the car in such a manner as to admit of the application of the Westinghouse appliance. . . . The present coupler, made of the proper amount and kind of material, if used in connection with the Westinghouse draft rigging, will be sufficient for the present; and if it is found that it is not of sufficient strength, any of the parts can be strengthened without materially affecting the application of it to practically all the cars in service. . . . There are certain features necessary to a satisfactory coupler, and upon which it might be well for the railroad managers to unite; the principal one of these is an automatic lock set.

I quite agree with what you state, that the spring draft gear for freight cars is only a passing expedient. The introduction of heavy cars and locomotives, in my opinion, makes its prompt passage absolutely necessary to an economical operation and maintenance of freight car equipment. I know of no other device that will meet the severe requirements of the present service as well as the Westinghouse friction draft gear. It is also, in my opinion, absolutely necessary that the couplers be strengthened in the shank back of the head. It would, of course, be a matter of great importance and profit to railroads if it were possible to standardize a rigging and coupler. The coupler of the future will have to be made of the very best grade of steel, using more of it than is now the case.

The main objection to the Westinghouse gear outside of the extra first cost is that it calls for a coupler which differs in its shank from the M. C. B. standard. Were it not for this I should recommend it for use on heavy freight equipment. Concerning the question of the technical departments selecting the good points of all the M. C. B. couplers with a view to obtaining the best in each which could be consolidated into one standard coupler which any manufacturer would have an opportunity to make upon requisition from a railroad company, I am very favorably impressed with this idea, and, as you say, there is practically no profit in the patents of the present day, as couplers are now sold on the usual commercial profit for the material furnished, and if the above result could be accomplished, I cannot see wherein it would affect the manufacturers of couplers in the least, as those furnishing first quality of material would probably get nearly as much business as at present, and those furnishing inferior material must soon go out of business. The only difficulty which would arise would be the maintenance of the couplers now in service, and whether or not the new design of coupler could be utilized with our present draft riggings in light capacity cars without materially changing them. My opinion on this subject would be that we would continue to maintain couplers on our light capacity equipment of the present M. C. B. standard dimensions and use the modified coupler with a new design of draft rigging only on new equipment as purchased. I cannot agree with Mr. Westinghouse's statement so far as our equipment is concerned that 70 per cent. of the crippled cars now awaiting repairs are due to defective draft gear, as such is not the case on this line. We use the Graham draft gear very largely and I have never seen a broken Graham draft gear; and with malleable iron dead blocks, our failures of couplers are reduced to a minimum. We also find break-in-twos since all cars were equipped with M. C. B. couplers reduced to a minimum In fact we have an exceedingly few break-in-twos, which we attribute to the M. C. B. type of coupler and dead blocks.

The proposed adoption of standard coupler and draft gear would be a very desirable thing if it could be accomplished. I am strongly of the opinion that it would be next to impossible to get either the coupler companies or the railroad officials to agree upon the practical annihilation of all the types of couplers except one, and the same is also true, I believe, regarding draft gear. There are many good points in many of the couplers in existence, and the adoption of one to the exclusion of all the others might have a tendency to discourage improvement. In fact, I think that very probably such would be the result. Equally so would this be the case regarding draft gear. I can see that Mr. Westinghouse, after spending large sums of money experimenting, would be very anxious to have a standard draft gear for all cars adopted, especially if it was the Westinghouse friction draft gear. I am not prepared to recommend the general adoption of the Westinghouse gear. It has some excellent points, but has shown some weak points, which may have been overcome recently, but which have not been tested long enough to fully demonstrate that the improvements are all that should be required in a first class, up-to-date, ahead of the times. draft gear.

I am favorably impressed with the proposition of selecting some form of draft gear and coupler, by combining the best parts of the different patents, which shall be standard for all new cars. I think this could be accomplished by an exchange of licenses that would be equitable to the different manufacturers.

The movement of heavy freight trains and heavy cars has demonstrated that the spring draft gear and couplers in common use are unequal to the strain imposed. I, therefore, consider the suggestion made by Mr. Westinghouse very opportune and good. I fear, however, that difficulty will be experienced in securing its universal adoption. We would be glad to co-operate with the other roads therein.

In my opinion the selection of a standard coupler for general use is desirable and practicable, both from a mechanical and a commercial standpoint, and I think, as suggested by you, this coupler should be a composite affair that will combine the best features of all couplers that are now in use on 20,000 or more cars. With draft gear, however, I think the situation is quite different. The number of designs for stronger draft gear so far brought out is limited, and but one or two of them has been tested to any extent in service. I think the agitation of the question for having a standard draft gear is entirely proper, and a move in the right direction. At the same time I think it would be unwise with our present limited information to decide now on any design of draft gear strong enough for present and future requirements.

Wide Fire-Boxes and Exhaust Nozzles.

A contemporary recently criticised the statement made by Mr. J. Snowden Bell in the *Railroad Gazette* (October 12 last) that other things being equal, a narrow fire-box requires a smaller exhaust nozzle than a wide fire-box. In an attempt to prove that this was untrue, some so-called "examples from recent practice" were given, that were plainly comparisons between wide fire-boxes for anthracite coal and narrow fire-boxes for bituminous coal. Comparisons so loose are usually misleading as they are in this case. To determine a question of this kind the engines compared should not only be of similar size, but they should burn the same class of fuel, and be used in the same service.

As the new wide fire-box engines of the Chicago & Northwestern offer a very good opportunity for such a comparison, we asked Mr. Robert Quayle for his opinion, which is very clearly given in the following letter: "I have your letter asking whether a larger exhaust nozzle opening can be used with a wide fire-box than with a similar locomotive with narrow fire-box. I think, perhaps, if you put the question to me in another way, I would answer it more emphatically, viz.: Can a larger exhaust nozzle opening be used with a fire-box of large grate area than with a fire-box of smaller grate area? The reason for this distinction is that a narrow fire-box (although this is not always practicable) can be made long enough to get the same area, and in that case might get the same results. Assuming that you mean just what I have called attention to, I say, yes.

"Our Northwestern type of passenger engines have 20 x 26-in. cylinders. We figured them to use 5¼-in. nozzles, and could make steam very nicely with that nozzle, but we found that the engines were more economical in the use of fuel when using a nozzle 5 in. in diam.; that is under the conditions of working when tested. I presume that under other conditions, with the engine worked at a longer point of cut-off, and at high speed, we might find the opposite of the test to be true; that we could then run more economically with a 5¼-in. nozzle than with a 5-in. nozzle. But so far as the steaming of the engine is concerned, with our Western coal these engines can be made to steam with a nozzle as large as 5⅜-in., and I believe with Eastern coal they could very easily use a 5½-in. nozzle without detriment. The nozzle used in this engine as the result of the large grate has an advantage of at least ¼ in. in diam. over our engine, Class D, with 30 sq. ft. of grate, having 19½ x 26 in. cylinders, 2,500 sq. ft. of heating surface, 75-in. drivers over tire, and 190 lbs. steam pressure."

The youngest of the railroad clubs is, we believe, the Rocky Mountain Railway Club, having its headquarters at Denver. At the last meeting of the club the membership amounted to 138, including all departments and classes of employees from General Manager to car repairer. The officers "hope to develop a club which shall have an educating influence on the officers and employees of railroads centering in Denver." This strikes us as a sufficiently modest hope, for no doubt the influence of the club will be felt by men belonging to railroads elsewhere. Indeed, the stimulating value of the railroad clubs is hardly to be exaggerated. Like the public schools of our country, they are inducing the habit of thinking and of thinking to a purpose, which work is probably even more important than their direct work in spreading information. We are quite aware that in a way these railroad clubs are directly opposed to the interests of the *Railroad Gazette*. It very often happens that men take their information and their ideas to their local railroad clubs for publication and discussion, whereas were it not for those clubs the *Railroad Gazette* would be the means through which they would come before their fellow-workers. Obviously, too, considerable money is spent in advertising in the publications of the railroad clubs, some unknown percentage of which might be spent in the advertising pages of the *Railroad Gazette* if the proceedings of the clubs did not exist. While these things are true and are important, and while they make life for all of us more "strenuous," yet as a general principle it is also true that with the growth of intelligence among railroad men—the growth of the habit of reading, thinking and discussion—so will grow the field for the railroad paper. In other words, we cannot help but share in and profit by the intellectual activity of railroad officers.

NEW PUBLICATIONS.

Specifications for Steel Bridges (taken from "De Pontibus"). By J. A. L. Waddell, C. E., etc., 12 mo., 178 pages, index. New York: John Wiley & Sons, 1900.

This volume is made up of chapters 14 to 19, inclusive, of Mr. Waddell's book "De Pontibus" with a number of tables and diagrams and with a very full index. It has been decided to print these specifications separately from the book itself in order to make them convenient and cheap for use in draughting and computing. A few changes have been made to bring the specifications up to date. The principal ones are the adoption of additional live loads to provide for heavier engines; increase in head room under bridges to 23 ft.; the adoption of rollers surrounded with oil, a detail in the author's practice; modification of formulas for man power apparatus for draw spans; slight changes in percentages of elongation; modification of requirements for tests of full sized eye-bars; a small reduction in intensities of working stresses for rivets. The other changes that have been made are said to be too insignificant to be worth mention. Doubtless the volume will be convenient and useful.

Transactions of the American Society of Mechanical Engineers. Vol. XXI, 1900. New York: Published by the Society, 12 West 31st street.

This volume of the Transactions of the "Mechanicals" covers the fortieth meeting in New York City in 1899, and the forty-first meeting in Cincinnati in 1900. It is a volume of 1,177 pages, with 372 illustrations and index.

TRADE CATALOGUES.

Wyckoff, Seamans & Benedict, New York, have issued an ingenious folder entitled "Right of Way for the Remington." When opened the folder measures nearly 6 ft. long, is printed in colors on both sides, and represents a freight train of 29 cars with engine and caboose, each car showing the trade-mark of a different railroad and stenciled to show the number of Remington and of all other makes of typewriters used in the general offices of the various systems represented in the train. The figures show that the 29 roads (all large trunk lines) use 2,911 Remington typewriters and 553 machines of other makes.

Train Delays.

(*Concluded from page 780.*)

Improper Train Orders.—To the train despatcher is often charged the responsibility for all the mental and bodily ailments of the engineer, conductor and brakemen, and in some cases he is blamed for all the shortcomings of the entire official list, from General Manager to Station Agent. This opinion, however, is confined to those of us who are but slightly acquainted with the intricate and serious nature of his duties. We may, however, be permitted to call attention to some of his errors in handling trains, to which could be attributed serious delays. A train having the right of track, according to the time-card rules, got late on account of meeting a large number of trains moving in both directions. In this instance orders were given. A regular train leaving its terminal was given a positive meet with late train before mentioned at a given point, which was a non-telegraph station. The late train, at a telegraph office further up the line, received an order that train following the one mentioned as leaving the terminal would have right of track between certain points which covered the meet made with the first train out of the terminal. The result was the second train passed the first train out of terminal at a point where she had gone into siding for the meet with the opposing train. The claim laid in this case was that second train out from terminal should have carried first one orders, or at least have stopped when passing them and given the other crew a chance to put on flag to help them out of the tangle in which they became involved.

From men who know what they are talking about, we have gleaned the following data, for examples: Two freight trains have orders to meet at a station where there is but one side track, which is only long enough to hold one train. The train going east has orders that a passenger train going west, which is due to arrive at that station shortly after they had reached there, was running forty minutes late; the crew on the freight train going west knew nothing of the passenger train being late, so they came into the station and stopped at the first switch, expecting the east-bound train to back out of the siding so that they could get out of the way of the passenger train at the station, then saw by while the passenger crew were doing their work. But the crew on the east-bound train knew that the passenger train was late, and supposed that the crew on the west-

bound train had received orders notifying them of this fact, and expected the train going west to go through without stopping, thereby giving the east-bound train a chance to go one station farther for the passenger train. This was made impossible on account of the time lost by the west-bound train stopping to take siding, and by the time orders were given them, so much time had elapsed that neither train could move, so they were both compelled to remain at the same place for the passenger train, and saw by. The passenger train lost 18 minutes by this proceeding. This time was made up on the passenger engine, which extraordinary speed caused a pin to heat and five minutes were lost in cooling the same, which was turned in by the despatcher as an engine failure. Both freight trains lost fully three-quarters of an hour. This could have been avoided by giving the freight going west orders at the last telegraph station they passed, where they stopped to pick up a car.

A delayed passenger train going east is given orders to meet two sections of a passenger train at a certain station, and acting upon the same proceeds to the station designated in the orders and takes the siding.

The station where the trains were given orders to meet was not a stopping point for the west-bound trains, but owing to the carelessness of the despatcher, orders were not given to them until they got to the meeting point, where both were stopped and given the order to meet the train that was already there, causing a delay to both sections of the train of five minutes each. This could have been avoided easily by giving the west-bound train orders at the station where they made their last regular stop.

A limited train arrives at a division terminal 15 minutes late, and is ready to leave in five minutes, but is given orders to run 30 minutes late. This necessitated a wait of 10 minutes at the station, and the schedule of the train being so fast that no time could be made up, this 10 minutes that was spent in idleness at the station, caused the train to arrive at its destination so late that important steamer connections were missed.

In regard to freight train crews handling cars an unnecessary number of times the following instances are a fair example of the manner that prevails of doing this work in some localities: A train leaves the eastern terminus of a division with orders to stop at a junction and fill to its full tonnage, which is done in due time, and the train proceeds on its way a few miles further when it is stopped and ordered to set out all or part of the cars then in the train, and pick up others. This the crew proceeds to do, and after the task is completed the train starts once more for its destination. An hour or so later another train comes along going in the same direction, and after turning the yard upside down, finally succeeds in switching the cars, which the train preceding it had set out, from among other cars that have since been put on the same siding by a train going in the opposite direction. By this method of doing work both trains were delayed, and the cars that they desired to rush did not reach their destination as soon as they would have done had each train been allowed to fill out to its required tonnage and haul the cars as far as they were required to go instead of spending the time in setting out and picking up cars, when such work was unnecessary.

Another noticeable evil which could be handled and prevented by despatcher is the holding of three or four trains at stations, while one of them is switching and keeps yard blocked. Again a stock train pulls into an intermediate terminal, an engine and crew is on hand ready to take the train out, but is held for five hours waiting for stock to be watered and fed. This crew only got in off a long trip, and had called for rest, but on account of the train being an important one, consented to go out. The conductor who had failed to inquire and notify despatcher of the intention to lay over for feeding of stock, should be severely dealt with.

Short Side Tracks.—The constant increase in length of trains due to the enlarged capacity of locomotives, together with large increase in traffic during the past few years, has demonstrated the necessity for longer and more frequent passing tracks. Many of the delays charged as engine failures and other accidents could have been avoided, if side or passing track facilities had been adequate; so that trains could meet or pass without resort to sawing by. It is impossible for a train despatcher to calculate with any degree of accuracy meeting points for trains when handicapped by short side tracks.

Poor Coal and Improper Distribution.—The quality and distribution of coal enters largely into the delayed train question, especially where comparisons of performance are made. The chief complaint from this source being delays for lack of steam. Engine failures for want of steam are of daily occurrence. There is nothing more discouraging to an engineer than trying to get over the road with a poor steaming engine. The best coal is generally the cheapest, when everything connected with the fuel question is considered.

Improper distribution is one of the worst features in the coal question. For instance, we find on some roads several kinds are used; one kind is used on one division, and another kind somewhere else, and ofttimes the several kinds are dumped on one division. In the latter case there is a constant complaint from everybody. Engines cannot be arranged to burn successfully several kinds of coal. To endeavor to do so always causes trouble and dissatisfaction, especially to those who are held responsible for delayed trains and engine performance, and it is a heart-breaking struggle for the Division Master Mechanic to try and keep in line with the other fellow who gets the good coal. He is forever changing grates, front ends or nozzles, taking a brick out of the arch or putting one in, but these expenses are never charged against the cost of fuel. They go into his cost for repairs, and every month cost per mile is higher than some other Master Mechanic, and his delays more numerous.

Poor Firemen.—On some roads there is very little attention given to the hiring of firemen. There is a carelessness displayed in this important branch of railroad service that is almost criminal, when we know by governing rules that the preceding generation is the next succeeding, and that to the firemen we are compelled to look for our future engineers. We wonder why more care is not exercised in selecting men for this position. If the amount of money expended in fuel and wasted in trying to make good firemen out of material that we find being hired every day could be computed the figures would be startling, and would certainly result in an immediate change of methods. Engineer failures in many cases are due to the man having been a poor fireman. Poor steaming engines that delay trains are very often made so by poor steaming firemen. Poor firing is responsible for many boiler failures, such as leaky flues, grates burned out, etc. Dirty fires, made so by ignorance or carelessness, often delay trains, and at times cause flues to leak and other troubles that bring forth the remark that "engine is no good."

Unnecessary Switching.—This cause of delay is generally the outcome of having inexperienced or careless train crews. It is a well known fact that some trainmen will take hours to switch out a few cars that could be handled in a few minutes by intelligent and active brakemen. The advent of the air-brake has had a tendency to lessen the brakeman's interest in train work, many of them being little more than passengers, so far as the amount of work on the road is concerned. The making up of train at terminals has much to do with switching en route, no attention being given to placing cars in station order. Switching with a string of cars attached to the engine is slow work, wastes fuel, and in many cases before the work is finished several couplers have been pulled out or knuckles broken, further delaying the train, or just as likely several trains. Where switching has to be done at way stations, it should be all done if possible by one train, and not have every train that comes along do a portion of it. Agents are responsible for some of this switching delay, in trying to divide up the work between crews. Train despatchers should watch this work closely and check systematically all delays from this source.

Station Facilities.—The placing of water tanks where they are needed, and in a position so that they can be used by enginemen while work is being done by train crew at stations, is an item of vast importance to trains that are expected to make fast time, for every minute wasted in making unnecessary stops increases the schedule in proportion to the time lost. Ash pits should be placed at water tanks. At division terminals and all stations where large express shipments are made and heavy baggage is handled, enough help should be employed to handle the goods as quickly as possible. Frequent complaints are heard from passengers, especially ladies, who are compelled to get on and off trains without assistance on account of brakemen having to load or unload baggage and expressed goods.

Obsolete Equipment.—Some of our train delays may be consistently charged to continuance in use of car and engine equipment that is out of date. Special reference might be made to couplers. There is nothing in the car department that is giving as much trouble as the coupler question. Passenger trains are constantly held at terminals and interchange points to change couplers to suit equipment of receiving road. Obsolete air appliances are still in use on many roads. We were surprised to learn that straight air is still in use on a well known road. Engines are very unhandy in many respects. Much time and expense is incurred on this account. It frequently happens that a train is considerably longer in getting over a division than it should have been on account of engine not being equipped with improved appliances for cleaning the fire. Loss of time from this cause can be easily and cheaply avoided by the use of air dumping ash pans and proper tools for cleaning fires being kept on the engine. Much time can be saved and delays obviated by having engines supplied with up-to-date tools and blocking for emergency purposes. Old-fashioned tools in repair shops are indirectly causes for delays.

Responsibility.—The responsibility for train delays rests with nearly every man connected with railroads, from general manager to the section foreman, and to suggest remedies for all the contributing causes, would be a task too gigantic for your committee at this time. We will, however, ask your consideration for a few that have been received from various sources.

The most important of all is a careful selection of men for all departments. For no matter how perfect your system of operation may be, careless and incompetent employees will destroy and render it useless. Following this should come a rigid and closely adhered to system of discipline. Reports from subordinate officials, regarding misdemeanors by men under their charge, should always receive the most careful attention. Employees in any department must understand that they are responsible to the foreman immediately over them. In disposing of cases reported, the man directly in charge should always be consulted, and his consent to the verdict rendered be obtained. Too much authority cannot be given to those who know how to handle it. The harmonious co-operation of all departments on a railroad is absolutely necessary to its successful operation, for without a union of the forces, a united effort for reforms is impossible. Imaginary lines that have always been drawn between departments should be eliminated, and we should remember only that we are men, and strive by individual effort to make the road we are working for a prosperous and paying concern. This can only be done by each department correcting its own fault, and in so doing all will be kept so busy that there will not be time for a single individual to stand and point the accusing finger at his fellow-workman in another department, for he will be kept too busy correcting his own mistakes.

Many other suggestions could be added, such as "double tracks," "block signals," "short districts for train despatchers," "improved terminal facilities." But we trust all of this will be brought out in the discussion that follows.

Suggested Remedies.—It may be deemed a superfluity to suggest a remedy for a delay or number of delays where their causes are apparent to the most casual observer. If we may presume to suggest remedies for delays, we would endeavor in particular to impress that it is more necessary to fix the cause of the break than the break itself. A single delay of almost any nature is in a measure excusable, but its frequent repetition, never.

Placing the responsibility is probably next in importance. This should be carefully accomplished without fear or favor. So we would suggest as a preliminary remedy for all delays to show them up—let us know who are responsible. If the General Manager lays down rules or inaugurates methods that are primary or secondary causes for delays, show them up. He will thank you for it. If the Superintendent overloads the engines through zeal to make a tonnage record, show it up, and he will eliminate the cause. If the man who makes the time card arranges a schedule with faster time up hill than down, or does not allow for a prevailing wind, or for cleaning fires, loading baggage, taking water, or a similar cause, register your complaint. If the train despatcher forgets to give an order, so that the train must make an extra stop for it, show it up. The engineer's and conductor's reports go to the Superintendent. If they don't check, the Superintendent will look it up. If the conductor loiters, gossips, and fails to get out of stations, show him up. If the fireman is incompetent, wasteful or negligent, he should be turned in by the engineer. If the engineer is lacking in judgment, knowledge or skill, show him up. If the purchasing department buys poor material, furnishes poor fuel, or poor iron, show it up. In conclusion, we will again urge that the responsibility for delays be sifted down.

The Albany & Hudson Electric Railroad.

Last Thursday the formal opening took place of a remarkably interesting electric railroad line between Hudson, N. Y., and Rensselaer, formerly East Albany, a total distance of 37.2 miles. This is a single track road, and is designed for carrying freight as well as passengers. The overhead trolley is used in the cities of Hudson and Rensselaer. Otherwise, the conductor is a third rail. The road is standard gage laid with T-rails, 80 lbs. per yard, and is equipped with 20 cars, each of which is provided with shoes for collecting current from the third rail as well as with a trolley pole for taking current from an overhead wire.

The company working this road also works the local street lines in the city of Hudson, and supplies lighting current, public and private, for Hudson and Rensselaer.

Power is supplied from a central power house at Stuyvesant Falls, and there are four sub-stations. The power house is about 3,000 ft. distant from the Falls, where a dam is placed, and from this dam water is carried in steel pipes to the turbines in the power house. In all there are 10 turbines, three of which are supplied with water by 7½-in. pipes, and the others by smaller pipes. The head is 104 ft., and the water delivered will be about 1,200 gallons per second. A steam engine capable of developing 2,500 h.p. has also been installed for emergencies. The turbines are designed to develop 6,000 h.p., 4,500 from the three large turbines and 1,500 from the seven small ones.

The current is put on the main conductor at a tension of 11,000 or 22,000 volts, dependent upon locality, and is stepped down to 600 volts in the four sub-stations.

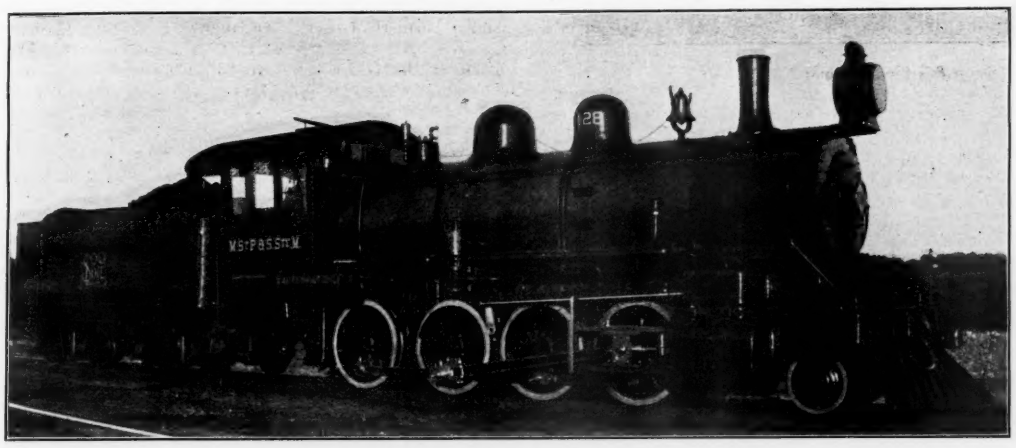
There are in the power house eight direct-connected turbine-driven, electric generators, in addition to the exciters. Three of the generators are of the three-phase type, 750 K. W., giving 12,000 volts at 60 cycles in each phase. The current used for railroad traction and for sale is generated by these machines. The section of the road nearest the power house is supplied with current by two 200 K. W. multi-polar 600-volt direct-current machines, the power house thus acting as a sub-station for this part of the line. There are also two 125 K. W. and two 250 K. W., 2,200-volt, single-phase alternating machines, that furnish light for Rensselaer and Hudson, and while some lights are fed direct from these machines, the current for the long distance lighting is

stepped up to 11,000 or to 22,000 volts for transmission, according to the need. The exciters, of which there are two, are 40 K. W., 60 volts. Two of the 250-K. W. single-phase machines and one 750-K. W. machine can be driven on occasion by steam engines, which are provided against failure of the turbines from any cause. At the sub-stations the high-tension alternating current is first put through transformers and thus reduced to a voltage suitable for the rotary converters. The current is thus changed to 600 volts, direct current, and at this pressure it supplies the third rail.

All of the electrical machinery for cars and power station was supplied by the General Electric Co.; the turbines by Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio; and the cars by the Wason Mfg. Co., Springfield, Mass. The name of the company working this line is Albany & Hudson Railway Power Co., and its principal officers are: Charles H. Werner, President; L. B. Grant, Secretary, both of 32 Nassau street, New York, and A. M. Young, Treasurer, 100 Broadway.

Schenectady Compound Consolidation Locomotives—Minneapolis, St. Paul & Sault Ste. Marie.

The accompanying illustration is from a photograph of one of six two-cylinder compound consolidation locomotives recently built by the Schenectady Locomotive Works



Schenectady Compound Consolidation Locomotive—Minneapolis, St. Paul & Sault Ste. Marie.

for the Minneapolis, St. Paul & Sault Ste. Marie Railway Company. The engines are designed to haul 1,692 tons, not including the engine and caboose, up a 42 ft. grade 10 miles long, while working compound. We are informed by Mr. E. A. Williams, Mechanical Superintendent of the railroad, that the locomotives have made their trial trip and are working satisfactorily. No explicit data is yet available bearing on the speed at which this load is hauled, or on the engine efficiency, but this we hope to publish later. In the general description may be found weight distribution, working steam pressure, general dimensions, and materials and devices as especially used.

General Description.

Builders	Schenectady Locomotive Works
Type	Compound consolidation
Cylinders	22½ and 35 in. diam. x 30 in. stroke
Tractive power	38,660 lbs.
Valves,	H. P., piston valve; L. P., Allen Richardson balanced
Driving wheels	55 in. over tires
Weight on drivers	154,500 lbs.
Weight on truck	21,600 lbs.
Total weight engine	176,100 lbs.
Weight of tender loaded	115,600 lbs.
Total weight of engine and tender	291,700 lbs.
Rigid wheel base	16 ft.
Wheel base of engine	24 ft. 1 in.
Wheel base of engine and tender	53 ft. 9 in.
Boiler, straight top	Radial stays
Working steam pressure	210 lbs.
Diameter of boiler at arch	73½ in.
Fire-box	Length, 120 in., width 41 in.
Tubes	320; diameter, 2 in.; length, 14 ft.
Heating surface.	
	Firebox, 193 sq. ft.; tubes, 2,356 sq. ft.; total, 2,549 sq. ft.
Grate area	34.16 sq. ft.
Height from top of rail to top of stack	14 ft. 10 in.
Height from top of rail to center of boiler	8 ft. 6 in.
Tender, capacity	Water, 6,000 gals.; coal, 10 tons

These engines have Westinghouse air-brakes, Corning brake-shoes, Washburn couplers, Sellers' and Ohio injectors, Jerome packing, Leach sanders, Detroit lubricators, Standard driving-wheel tires, cast-steel wheel centers, Westinghouse friction draw gear, steel channel tender frames, Common-sense body and truck bolsters, and cast-steel driving boxes.

Labor, Power and Tools in Shipyards.

At the meeting of the Society of Naval Architects and Marine Engineers, just held in New York, a paper on Recent Improvements in Foreign Shipbuilding Plants, was presented by Assistant Naval Constructor H. G. Gillmor, U. S. N. Some extracts follow.

Effect of Trades-Unions.—In connection with the arrangement, and before touching upon the question of plant, it may be pointed out that the effect of trades-unionism is nowhere more to be seen than in the development of shipbuilding plant in England. Practically all the steel work about a shipyard is paid for by the piece, and the resistance of what is known as the Boiler Makers' Society, a combination of all the iron and steel workers of the shipbuilding and boiler-making trades, to all reductions in piece prices, is so great, and their power is so felt among the shipbuilders, that it is impracticable to secure any adequate reduction in the cost of labor from improving the facilities for carrying on the work. It might be argued that it would be in the interest of the shipbuilder to improve facilities, in order to increase the output of his plant, even though he should get no direct return through reduction in cost of production. Unfortunately, it is too often the case that not even this return comes to the enterprising shipbuilder who improves his plant, for the broken time from which they suffer so much increases with the possibility of increase in earnings of the skilled artisans of the shipbuilding trades. This should be borne in mind when considering the advances made by English shipbuilders, for there are many enterprising ones who would have gone much farther in their improvements had the conditions been such as to make it possible to get any adequate return for the expenditure required. What has been said of the effect of trades-unionism does not apply to the same extent to German yards, and, as a rule, perhaps also partly through their being newer, one finds in them better arrangements and more labor-saving appliances.

Distribution of Power.—There was probably no form of industrial plant more wasteful of power than the average shipbuilding plant of 10 or 12 years ago, when ordinarily, steam was generated in one or more centers in the yard and distributed. The most striking improvement is the increasing tendency to do away with the steam-engine and piping system. Its place, for many purposes in the shipyard, is being taken by gas or oil engines and by electric motors.

Gas Engines.—There are few foreign yards to-day in which the gas engine is not to be found doing work which was formerly done by the steam engine; and, in at least one large and important yard, steam has practically disappeared except for the hydraulic pumps and the yard locomotives. The municipal gas companies, in nearly all cases, supply illuminating gas for fuel and power at a somewhat reduced price. In many cases, however, some form of low-grade fuel gas is made on the premises for gas-engine consumption. The Dowson and similar processes, by which a fuel gas, made up of hydrogen-carbon monoxide and the inert components of air, is produced from coke or anthracite, are generally employed for the purpose. So far as observed the engines used are, for the most part, horizontal single-acting, single-cylinder engines, working at from 120 to 180 r.p.m. upon what is known as the Otto cycle, giving an impulse for every two revolutions. Their use for driving all the shops, such as the machine and fitting shops, joiner shops, etc., is becoming more and more general, and they may be found applied to almost every purpose in the shipyard to which the steam engine has been applied, except for the direct driving of isolated machines. There seems little doubt that the advantages attending the employment of this type of motive power, under the conditions existing abroad, is more than sufficient to justify the outlay which the change in motive power involves. The managers of these yards in which gas engines are most extensively used express themselves as well satisfied with them as mechanical agents. They point out also the very great advantage which they derive from the saving of space by the doing away with steam generators in those cases in which illuminating gas is used, or the relegation of the smaller gas generators used in other cases, to the least valuable and useful space in the yard. In this connection it may be mentioned as a sign of the times that in one important German shipyard a considerable portion of the power of the shops is supplied by a pair of large Diesel oil engines.

Electric Motors.—While the gas engine serves very well for many purposes about the shipyard, it is not adapted to the direct driving of the several heavy machines, subject to more or less intermittent working, which have so prominent a place in a shipbuilding plant. In connection, then, with the changes in which the steam engine is supplanted by the gas engine for some purposes, it is not surprising to find its place, for other purposes, being taken by the electric motor. In the general industrial applications of electricity we are, in this country, well in advance of the old world; but in its application as a medium for the transmission and distribution of power in a shipyard, a great deal is being done abroad.

There are numerous examples of electric motors having taken the place of steam engines for driving all the heavy and fairly widely separated tools of the plating shops. In many cases motor driving has been satisfactorily applied to machines not originally intended to be so driven. The motors have shown themselves capable of working continuously or intermittently for long periods with, at any rate, not more attention than is generally required for steam engines employed for the same purposes, and provided with no other protection from the weather and the dust than a light wooden box or house with end panels of finely perforated tin or iron gauze. There are few examples of the driving of shop shafting by electric motors. The combination of gas engine driving, when power in large units may be employed as in shop driving with electric motors for the independent driving of isolated machines, or those of large size doing more or less intermittent work, seems to represent the most advanced practice abroad.

Hydraulic power is to be found in practically every yard in which vessels of any size are built. It is employed for the heavy flanging machines and manhole presses, and in many cases for operating the smaller cranes used in handling the heavy work at the machines.

Tools, Etc.—Toward improvement in appliances for handling materials at the ship, with perhaps two notable exceptions, little has been done in recent years. Comment upon this fact usually elicits the reply that it is useless to provide the workmen with facilities which render the handling of plates, etc., at the ship, easier when it is not possible correspondingly to reduce the piece price paid for doing the work.

The standard shipyard tools abroad have suffered very little, if any, change in type for years. Of the tools of the fitting shops and the joiner shop it may be said that, in a general way, the improved tools adapted to the work of each have been introduced to a moderate extent, and it is gratifying to Americans to find that in these shops many of the newer machine tools are of American manufacture. In the employment of portable tools at the ship very little has been done. There are considerable numbers of portable electrical drilling and countersinking machines in use even in some yards in which electricity is not employed for other purposes. Portable hydraulic riveters are also employed to a considerable extent for riveting up frames, floors, and longitudinals, generally at the building slip itself. Portable pneumatic tools, however, although used to a considerable extent in boiler shops, have thus far found an extremely limited adoption in the shipyards.

Coaling Ships at Sea.

Last year we described at some length the very ingenious apparatus for coaling ships at sea designed by Mr. Spencer Miller, of the Lidgerwood Manufacturing Co. Mr. Miller presented a supplementary paper on this at the last meeting of the Society of Naval Architects and Marine Engineers describing the working of the apparatus in a pretty heavy seaway. It is not necessary for us to describe it again; the coal is conveyed by cableway from the collier to the vessel to be coaled, the collier being towed at a safe distance behind the ship taking coal. There are ingenious contrivances for compensating for variation of speed in the two ships and for their pitching. The following is a brief account of trials made within the year.

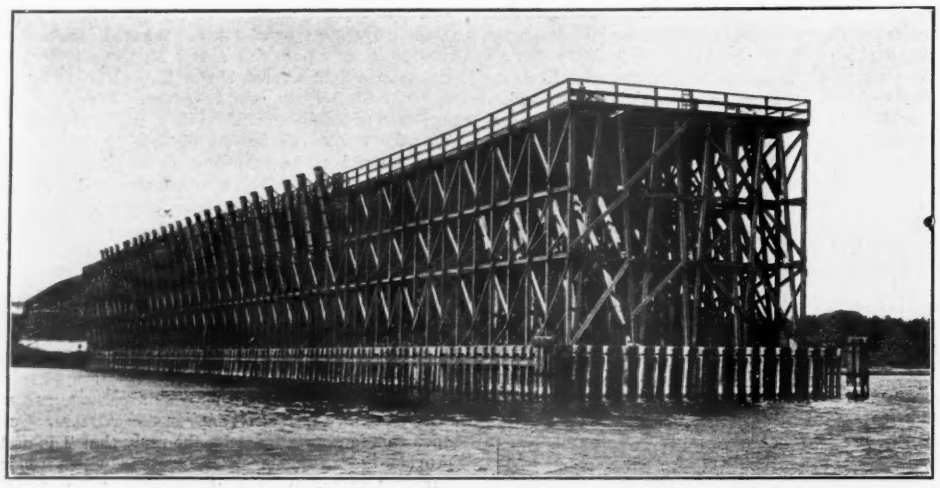
The apparatus had five trials. On the first day adjustments were made and nine loads only were sent over. On the second day more adjustments were made and a run of 38 loads in 38 minutes and 40 seconds was suddenly terminated through the lack of skill on the part of the operator, who allowed all the rope to be coiled on the forward drum. This slipped the clip on the end of the rope through the other drum and the rope fell into the sea. No damage was done, no one hurt, and the only penalty of such an accident was an hour's delay in rigging up again. On the third day in one hour the apparatus transferred about 22 tons, and the work would have been continued longer but for lack of sufficient crew to fill the bags.

The Navy Department ordered an endurance test of not less than four hours' duration, and a rough weather trial as well. The fourth trial lasted four hours. Seventy-five tons were handled in 3 hours and 43 minutes. The water was smooth, with a ground swell. In the fifth test—the rough-weather trial—80 trips were made in 80 minutes. The performance could have been continued for an indefinite time, but the board being satisfied there was no object in going further.

The boats steered at first head-on to the sea. The forecastle of the Massachusetts was washed at every plunge, and no coal could have been delivered there even if desired. A little more than 20 tons were handled in an hour. The course was then changed, quartering on the sea, and the results were the same. Then the boats steered in the trough of the sea, and a rolling of 7 deg. did not affect the working. The speed was maintained at about five knots. At 300-ft. distance between the ships, even in smooth water, the collier Marcellus followed badly, and when over 7 deg. out of her course the operation was stopped. In spite of stops, however, 20 tons per hour were delivered. During the rough-weather trial, however, and with about 400 ft. between the ships, the collier followed perfectly, and no time was lost.

The Curtis Bay Coal Pier—Baltimore & Ohio Railroad.

To meet the increasing movement of coal through the port of Baltimore from Maryland, Pennsylvania and West Virginia, the Baltimore & Ohio Railroad Company found it necessary to build at Curtis Bay a well equipped coal pier which should combine greater facilities than those which have heretofore existed at Locust Point, where their coal traffic has been handled. This pier, or dock, was completed in September and the first actual work of unloading cars into the hold of a vessel was done on Sept. 24. Illustrations herewith show a photograph of the pier and a portion of the bay and also line drawings of representative parts of the structure.



The Curtis Bay Coal Dock—Baltimore & Ohio Railroad.

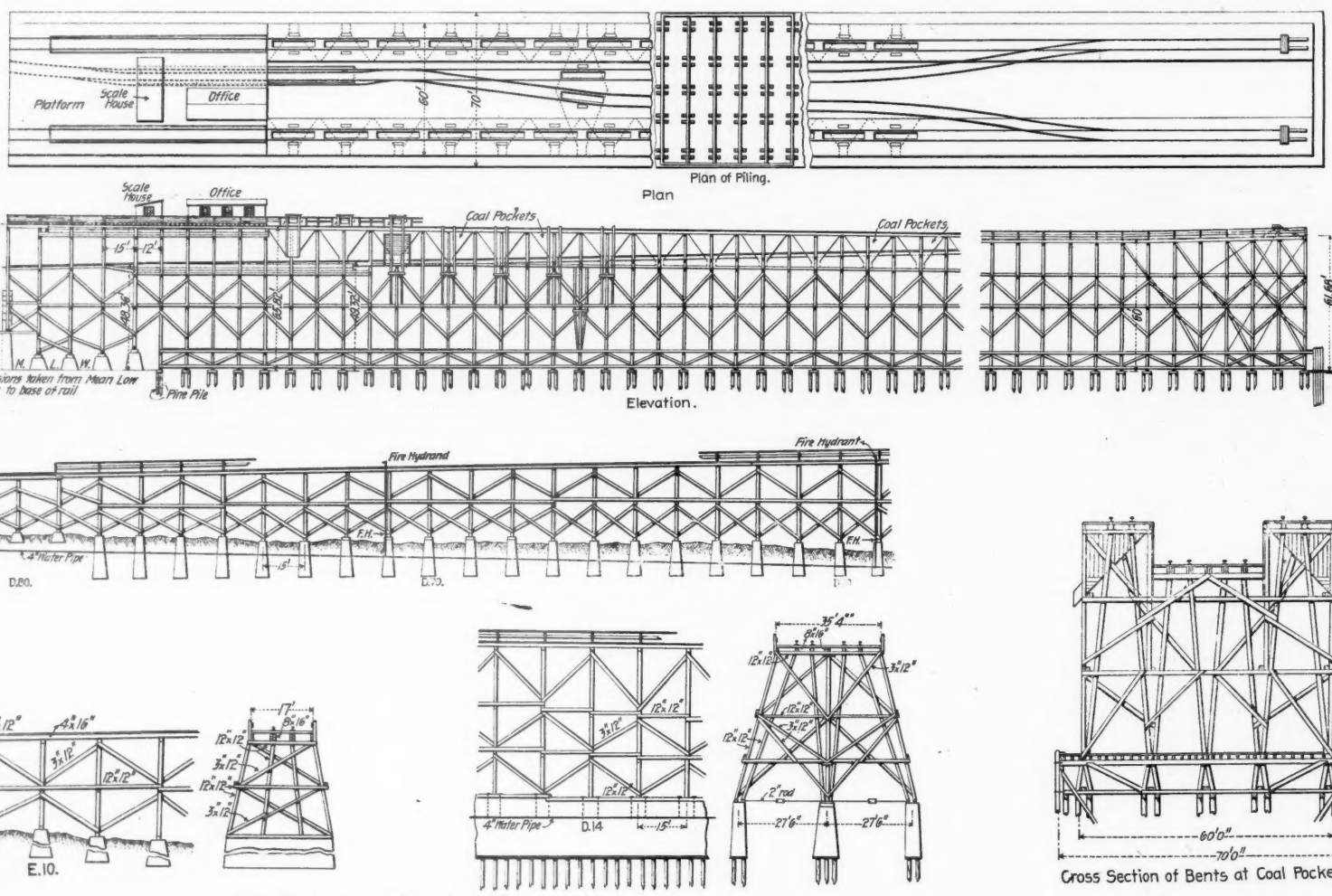
The dock is 800 ft. long from the shore line to the deepwater end, where it is 45 ft. high, the width being 60 ft. The approach is 1,000 ft. long, giving a grade of about 2 per cent. to the incline. This approach track rises from a yard which is now being built to have a capacity of 2,600 cars, and the branch line of the Baltimore & Ohio leading from the main line to this yard will be double-tracked and laid with 85-lb. rails from Carroll switch, where it joins the main line. A small roundhouse, a water tank and the other necessary small buildings will be built in this yard.

The cars, having reached the upper level of the dock, are run over 100-ton Fairbanks track scales, one in each of the two tracks, and are automatically weighed. Passing thus to the unloading pockets, of which there are at present 25 on each side of the dock and a final capacity of 100 pockets of 180 to 350 tons each, the cars are dumped and run by gravity to a switch back at the end of the dock. There they are shunted on to the return track and down an empty car incline of 1,800 ft. to the yard and are again weighed on automatic scales while in motion.

The combined unloading capacity of the several docks at Locust Point was approximately 8,000 tons in 10 hours, when cars of from 25 to 30 tons capacity were used. It is estimated that with the use of 50-ton cars the ultimate unloading capacity of the Curtis Bay dock will be about 10,000 tons, when vessels are promptly at hand to receive cargo. In bringing about this result it is intended, as the coal business of the port develops, to increase the number of storage pockets to the full number of 100 and to unload cars promptly on arrival, thus holding the coal in storage in the dock pockets and liberating the cars.

The formal opening of the dock was the occasion of loading the first of a cargo into the hold of the only six-masted schooner that has ever been built. This ship is the George W. Wells, which was launched a few weeks ago at Camden, Me. It is built to carry 5,000 tons of coal on a draft of 23 ft. On the day that the dock was opened five cars containing in all 250 tons of coal were dumped into the hold of the ship in about five minutes. The pockets are made of steel, each one ending in a spout that is lowered to the hatchway.

The general style of building, including the setting of piers under the several bents is apparent from the drawings. The pier is built of Georgia pine, of which there are some 8,000,000 ft. Various plan views and elevations, with cross-sectional views selected from representative parts of the structure, considered with the perspective view given in the photograph, convey a good idea of the work. It is intended to make and maintain a channel 30 ft. deep and 300 ft. wide from the mouth of the bay to the dock line of the pier in order that any vessel that navigates Chesapeake Bay may load at this pier.



Part Elevations and Sections of Approach

The Curtis Bay Coal Dock—Baltimore & Ohio Railroad.

TECHNICAL.

Manufacturing and Business.

The Powers Regulator Co., of Chicago, have equipped 25 new cars of the Seaboard Air Line with their automatic temperature regulator as a result of experience with it last winter.

The 20 passenger cars ordered recently by the Cleveland, Cincinnati, Chicago & St. Louis, details of which were published in last week's issue, will all be equipped with the Pintsch system of lighting.

Wm. B. Scaife & Sons, Pittsburgh, Pa., have been awarded contracts for supplying the steel frame construction for the United States Navy Yard at Port Royal, N. C. The work involves a large amount of heavy plate girders and cylinders.

The Graphite Metal Co. has been incorporated under the laws of New Jersey for the purpose of making metals of all kinds, but more especially castings from what is known as graphite steel, a metal similar to open-hearth steel, but containing considerable free graphite. It is claimed for this graphite steel that it is especially applicable to railroad uses because it destroys, to a great extent, vibration, and on account of its lubricating qualities. The President of the company is William B. Smith, formerly General Manager of the Atlantic Brass Co. and inventor of the A. B. C. journal bearing. The office of the company is at 15 Cortlandt street, New York, and the factory at Garwood, N. J.

Iron and Steel.

The Midland Ry. Co. of England, according to report, will replace the remaining 90-lb. rails with 100-lb., and will probably soon ask bids.

Seebohn & Dieckstahl, Ltd., proprietors of the Dannemore Steel Works at Sheffield, Eng., have secured a site somewhere near Pittsburgh, where the company proposes to build a crucible steel plant.

The corporate name of the Charles Efros Trading Co., Ltd., 11 Broadway, New York, has been changed to the Charles Efros Steel Co., and the charter amended to permit the company to mine, make and market coal, iron and steel and similar substances.

The Independent Iron & Steel Co. has been incorporated in Ohio with a capital of $200,000. The incorporators are: Wade A. Taylor, W. H. Smiley, Wm. Herbert, T. E. Thomas. The general office is in Niles, Ohio. A sheet steel mill will be built.

Automatic Signals on the Boston & Maine.

Automatic electric block signals are being put up at intervals of about one mile on the eastbound track of

the Fitchburg Division of the Boston & Maine, between Shelburne Falls, Mass., and Conway Junction, about six miles.

Rogers Locomotive Works.

A dispatch from Paterson, dated Nov. 25, says that the Rogers Locomotive Works will close Dec. 1. Only about 300 men are now employed. It is thought in Paterson that the efforts to arrange for carrying on the works by some other company have failed.

English Rail Order for Carnegie.

The London *Times* of the 27th, according to cable reports, prints correspondence wherein Lord Claud Hamilton, Chairman of the Great Eastern Railway, explains that the company was compelled to place a large order for rails and fish plates with the Carnegie Company because the contracts with English companies were in arrears. He says, also, that Carnegie's price was lower than that quoted by the English concerns.

Green for All Clear on the Alton.

The Chicago & Alton has changed all of its fixed signal lamps so that green is the indication for all-clear at night on such signals throughout the company's lines. "Nels" red glass has been adopted for the stop indication in all home signals and "Nels" yellow for distant signals. The total number of fixed signals on the lines of the company, exclusive of switch lights, is 423. This includes 144 semaphores, 44 automatic electric stop signals and 41 automatic electric distant signals. The total number of distant signals is 110. On facing-point switches the lamps show green when the switch is set for the main line, and red when set for the side track. On trailing switches no lamps are used.

Electricity in Austrian Locomotive Works.

The electrical firm of Ganz & Co., of Budapest, is installing an electrical plant in the locomotive works of the Austro-Hungarian State Railroad Company at Vienna. There will be a three-phase generator of 300 kilowatts, direct-connected to a compound condensing steam engine. The generator makes 125 revolutions a minute at 200-volt tension. For repair work or minor working purposes a generator of 60 h.p. has been provided. For the beginning 40 motors of ½ to 30 h.p. will be installed, with a total capacity of 400 h.p. The machines in the machine shops, boiler shops, foundries, carpenter shops and erecting shops will all be driven by electricity. The works will be lighted by 40 arc and 250 incandescent lamps. During the last year the locomotive works at Florisdorf, near Vienna, were provided with electric motive power, consisting of two dynamos of 300 h.p. each and one dynamo of 120 h.p. The vertical steam engines are direct coupled to the dynamos, and make 113 revolutions a minute.

THE SCRAP HEAP.

Notes.

The Cleveland, Cincinnati, Chicago & St. Louis has advanced the pay of many or all of its telegraph operators receiving $50 a month to $55, and those receiving higher rates are advanced in about the same proportion.

The Railroad Y. M. C. A. of De Soto, Mo., on the St. Louis, Iron Mountain & Southern is to have a new building, the railroad company having appropriated $4,500 for the purpose. The citizens of De Soto will give a like amount, and Miss Helen Gould has given $1,000 for a library.

Traffic Notes.

The West Shore has put on a new westbound train, known as the Chicago Express. It leaves New York at 1:15 p. m.

At Girard Point, Philadelphia, one day last week the British steamer Blodwen was loaded with 156,576 bushels of corn in 5 hours 35 minutes.

The New York Central announces that its 1,000-mile tickets, sold for $20 and good for bearer, are now good on all the lines of the Boston & Albany.

The Pennsylvania lines west of Pittsburgh have put on a new express train to run from Chicago to Pittsburgh, 468 miles, in 12½ hours. The train makes 12 stops.

The Canada Atlantic Railway announces that the amount of grain carried by it from lake vessels this year, nearly all of it presumably for export, was 14,000,000 bushels.

The railroads west of Chicago in issuing their holiday excursion tickets are allowing longer time limits than in former years. Those for Thanksgiving are good from Nov. 27 to Dec. 3, inclusive; those for Christmas, Dec. 22 to 25.

The Burlington road now runs three fast mail trains from Chicago westward. The third is a train which has just been put on to run to Lincoln, Neb., 555 miles, in 12 hours. It leaves Chicago at 8:48 a. m. At Lincoln connection is made with the Burlington Line to Billings, Mont.

The Southeastern Car Service Association, covering the states of Georgia, South Carolina and Florida, has voted to enforce a storage charge of one cent per day per 100 lbs. on freight remaining in freight houses more than 48 hours. The regulations will go into effect on Jan. 1.

The railroads of the Western Passenger Association on and after Dec. 1 will make a charge between all points for the transportation in baggage cars of bicycles, tricycles and baby carriages. Each article, whether crated or not, will be subject to a minimum charge as for 50 lbs. excess baggage. The minimum charge in each case is to be 25 cents.

The Pere Marquette Railroad is to make use of carrier pigeons on its six car ferries and on its steamers during the coming winter. The plan of communicating with the shore by means of pigeons was adopted because of the dangers of winter navigation, boats at times being caught in the ice, with no way of sending for aid. Wireless telegraphy was experimented with for this purpose, but appears to have been found not satisfactory.

The Lehigh Valley road, after conferences with its employees, has made considerable increases of the wages of brakemen on freight trains, and has agreed to allow enginemen more time for housing their engines at the end of trips. About 200 men in the shops of the New York Central at Depew struck on Nov. 22. On the 23d, after a conference between a committee of the men and the Superintendent of Motive Power, it was reported that a settlement had been agreed upon.

The injunction suits brought by the Illinois Central and the Yazoo & Mississippi Valley roads to restrain the Railroad Commissioners of Mississippi from enforcing reduced rates on cottonseed have been settled, the commission accepting the compromise offered by the attorneys for the roads. The roads agree to put commission rates in effect Dec. 5. Meantime the roads have hauled the bulk of the cottonseed crop at their own price during the two months of litigation, and are well satisfied.

The Choctaw, Oklahoma & Gulf has appointed an agricultural commissioner, with office at Little Rock. The duties of the agricultural commissioner "will be to create an interest among the farmers for the better cultivation of the land by organizing farmers' clubs, imparting information as to preparation of soil, cost of seed, methods of planting and finding markets for products. Likewise the establishment of creameries, raising of poultry and preparing same for market, growing of fruit and shipping of same." The commissioner is Mr. Charles Wallace.

Press despatches from Kansas City last week conveyed the information, in quite positive terms, that rates on provisions to the Atlantic seaboard were being constantly cut to very low figures, and that these low rates would continue until Jan. 1 at least; but this week other reporters learn that there is an improvement in the situation, and that the reports of cutting last week were, on the admission of the complaining railroad men themselves, exaggerated. The reader can take his choice. One traffic man says that "provision rates from Missouri River points are always unsettled."

The Interstate Commerce Commission held hearings in Chicago Nov. 19. One of the complaints was that of S. E. Carr, a traveling salesman, who made a contract with the Northern Pacific to haul his sample car for 15 through fares with stop-over privileges. The company demanded 15 local fares, and Mr. Carr complains. Another complaint was against the Great Eastern fast freight line. A consignee who had the claim for over-charge was told by each of the railroads in the line that they were not responsible, and also by the management of the line that it had no legal responsibility.

A correspondent of the *New York Journal of Commerce* traveling through the Southern States states that "it is easily noticeable that the disposition of the Southern people towards the railroads has of late years undergone a marked change from one of suspicion, if not of animosity, to one of friendliness. The gradual absorption of small impoverished and badly served roads into the greater trunk systems has removed many grievances; and improved service has increased local travel to a marked extent." The correspondent thinks that the cotton mills of the Southern States will induce the railroads to grant milling-in-transit rates, for the transportation of cotton from the fields to the factory, and for the manufactured product from the mill to the market.

Nebraska And Its Railroads.

Press despatches from Omaha state that the railroads of Nebraska are now intently watching the politicians of the state, who at the next Legislature, which meets in January, are likely to introduce a law reducing freight and passenger rates. It is said that the Republican leaders favor a proposition to make a general reduction of 15 per cent. The Newberry law, which was nullified by the Supreme Court because the reductions ordered by it were unreasonably large, contemplated reductions of 20 per cent. and more. The Supreme Court of the state last week gave its decision in the suit of the railroads to contest the powers of the State Board of Transportation, and held that the law creating this Board is unconstitutional. This leaves the state without any rate legislation whatever. The doings of this Board during the past few years, and the present status of railroad affairs in the state, are reviewed in the New York *Evening Post* as follows:

The Board was composed of three executive state officers, viz., the Secretary of State, the Auditor and the Attorney-General, who were the responsible members of the Board, yet the active and actual members were three secretaries appointed by the Governor, so designated in order to overcome the Constitutional inhibition to creating state offices other than those specifically named by the Constitution of 1875.

These secretaries have in recent years endeavored to compel the railroads to reduce rates, but every effort was met by resistance in the courts . . . The Supreme Court when composed of a majority of Republicans, decided the Board had power to regulate railroad rates; the present Supreme Court, dominated by Populists, annuls the law, but not until after the recent election made certain the appointment of three Republican secretaries instead of the three secretaries now holding office. Ever since the Populists gained the ascendancy, eight or ten years ago, successive Legislatures have sought to pass restrictive measures that would stand the test of the State and Federal courts, but the efforts signally failed. Laws were found by the railroad attorneys, and after a contest in the Federal courts lasting six years, the railroads won. The Legislature to convene in January is expected to pass a railroad regulation bill, though there is no general sentiment in the state demanding such a law.

The Sleeping Brakeman of Saxony.

The sleeping brakeman of Saxony, who, for nearly 18 years, lay in something like a trance, as the result of a railroad accident, as we related a few months ago, has met with a tragic end. Some of the neighbors reported that his condition was assumed for the sake of a pension, and they even pretended to have seen him by morning twilight get up and move about the house. The surgeons made experiments which convinced themselves perfectly that he was actually helpless; but that others might equally be convinced they decided to remove him to a hospital for two weeks where he would be under observation all the time. When the men went to fetch him, they found him with a pistol shot through his head and his wife hanging to the door. The poor woman, tormented by the evil tongues of her neighbors, had shot him and then hung himself. This has been one of the most wonderful cases in surgical history. An electrical current was passed through the man which would have compelled any man in normal condition to struggle violently, but this patient was absolutely passive under it. Neither did he make the slightest movement when needles were stuck into his legs or the soles of his feet. Only when his cheek was pricked there was a slight contraction of his forehead. Many efforts were made to flex his knee joints, but always in vain. And this lasted for 18 years.

Bridge Material for the Dutch East Indies.

The Colonial Ministry of The Hague, Holland, invites bids for the superstructure of 95 bridges on narrow gage lines on the islands of Java and Sumatra; further for the superstructure of 18 bridges on standard gage lines on the same islands. The Ministry is also in the market for rails, sleepers and other track material. Messrs. Nyhoff, of 18 Nobelstraat, The Hague, Holland, supply particulars.

Roumanian Rail Imports.

During the year 1899 the imports of iron and steel rails into Roumania amounted to 11,680 tons, valued at 1,868,826 francs. Great Britain supplied 5,972 tons at 955,585 francs; Germany, 2,110 tons at 337,622 francs; Belgium, 1,619 tons at 259,193 francs, and Austria-Hungary, 1,043 tons at 166,998 francs. The rest came from France. Nothing was contributed by the United States. There are now 1,932 miles of railroad open in Roumania, and there are 77 miles under construction and 360 miles under survey.

Train Robbery in Arkansas.

A passenger train of the St. Louis, Iron Mountain & Southern was stopped by robbers at Gifford, Ark., on the night of Nov. 11 and the express car was robbed of several hundred dollars (one account says $15,000). It is said that there were five robbers in the gang. They applied dynamite four times to the through safe, but failed to blow it open. The express car was completely wrecked by the explosion.

The British Pneumatic Railway Signal Company.

This is the name of the company which has been formed in England, as already announced in the *Railroad Gazette*, to introduce in Great Britain and the British Colonies the low pressure pneumatic interlocking apparatus for switches and signals, which, in this country, is made by the Standard Railroad Signal Company, of Troy, N. Y., as licensee of the Pneumatic Railway Signal Company, of Rochester. We understand that the stock of the British company has already been subscribed and that the concern has begun business. Steps have been taken to form companies to make and sell the low pressure apparatus in Germany and Austria.

Instruction of Trainmen on the Lackawanna.

The Delaware, Lackawanna & Western has issued to its employees a circular announcing that the International Correspondence Schools of Scranton have been authorized to instruct such employees as may desire, in mechanical and civil engineering, bridge engineering, steam and electrical engineering, mine engineering and coal mining, locomotive running, mechanical drawing, drafting, painting and train management. The courses include locomotive construction, maintenance, care and running (simple and compound); the construction, testing and operation of the Westinghouse and New York air-brakes, and the Westinghouse train air-signaling system; train rules governing movement of trains on single and double track, including telegraphic train orders, and rules governing fixed signals (automatic, block and interlocking). The course for employees in train and yard service embraces the train rules, signal rules, train orders and fixed signals; air-brakes, train air-signal, car heating, etc. The train rules and rules governing the block system are those formulated by the American Railway Association, and soon to be adopted by the Lackawanna. One of the Correspondence Schools' instruction cars will soon go over the road.

Electric Traction in New York.

President Vreeland, of the Metropolitan Street Railway Co., announced last week that the work of converting the motive power of the Broadway, Lexington and Columbus avenue lines from cable to the underground electric system was completed. The railroad company will wait until spring, however, before replacing the cable cars by those equipped for the new system. The running of electric cars on 42d street and the installation of the underground system on Broadway, Lexington and Columbus avenues, complete the changes planned for this year. The company will next improve the transit facilities on Eighth and Tenth avenues.

Widespread Windstorm.

On Nov. 21 and 22 damage was done by windstorms at many places throughout the Eastern and central portions of the United States. In Northern New York State many freight cars had their roofs blown off. At Tonawanda, N. Y., thousands of dollars damage was done in the lumber yards. At Colorado Springs, Col., the velocity of the wind was 85 miles an hour; telegraph and telephone lines were wrecked, and many street cars were overturned. On the plains the movement of railroad trains was greatly interfered with by drifting sand. The storm was unaccompanied by rain or snow, and the sandstorm was similar in its nature and effects to the sandstorms of Arizona.

Nine Passengers Killed in Germany.

The passenger train disaster near Offenbach, Hesse, reported in the press despatches of Nov. 9, proves to have been a rear collision on a line where space-interval regulations were in effect. The foremost train was one traveling from Berlin to Frankfort-on-the-Main, and the nine passengers were burned to death. The engineman of this train, in a dense fog, ran past the signal at a block station more than the length of the train. He stopped as soon as possible and backed up; but by the time he got back to the cabin the signalman had permitted a second train to come on from the station in the rear, and the collision ensued. The rear car was one of the modern Prussian parlor cars, whose compartments open on a side passage, and which is entered at the ends, like American cars. The shock wrenched the compartment doors so that they could not be opened; a hole was punched in the gas-holder underneath the car, from which the strongly compressed gas issued in a long stream, which took fire and immediately set that car and in a short time the next one in flames. In the rear car the passengers could not get out of the doors of the compartments, and those who were rescued escaped through the windows. It would be difficult to say which is the greater, the recklessness of the engineman in backing into the section he had vacated, or the stupidity of the signalman in admitting the second train.

LOCOMOTIVE BUILDING.

The Northern Pacific is reported in the market for from 50 to 75 locomotives.

The Pittsburgh & Lake Erie denies that it is in the market for locomotives as reported last week.

The Wabash has been figuring on buying 50 locomotives. It is understood that an order has been placed, but we have received no official information.

The Chicago & Northwestern has ordered 20 loccmotives from the Schenectady Locomotive Works. We are not certain if this is a new order or simply part of a contract made some time ago.

The Lake Shore & Michigan Southern is reported in the market for a large number of locomotives. The number is stated to be 100. We have no official information but believe that the road has been figuring on getting some equipment next spring.

The Rio Grande Western has ordered five compound consolidation locomotives from the Richmond Locomotive & Machine Works. They will weigh 187,000 lbs., with 170,000 lbs. on the driving wheels, and have 23½ in. and 30-in. x 28-in. cylinders; 56-in. driving wheels; fireboxes, 122 in. long and 41 in. wide; steam pressure, 185 lbs. and a tender capacity for 6,000 gals. of water.

CAR BUILDING.

The Denver & Rio Grande has ordered one dining car from the American Car & Foundry Co.

The Illinois Central has ordered 300 refrigerator cars from the American Car & Foundry Co.

The Rio Grande Western has ordered 100 box cars from the American Car & Foundry Co.

The Fairchild & Northeastern has ordered five flat cars, of 60,000 lbs. capacity, from the American Car & Foundry Co.

The Florence & Cripple Creek has ordered 50 narrow gage, eight-wheel, gondola cars from the American Car & Foundry Co.

The Northern Pacific is asking prices on between 40 and 50 cars for passenger service, and is reported in the market for from 3,000 to 5,000 freight cars.

The New York, Chicago & St. Louis has ordered 10 passenger, one dining and five baggage cars from the Barney & Smith Car Co. The road is not in the market for 500 flat cars, as reported.

The Missouri Pacific, as noted Nov. 16, has ordered 500 furniture cars from the American Car & Foundry Co. The cars will be of 60,000 lbs. capacity, weigh 39,000 lbs., and measure 50 ft. long, 8 ft. 9 in. wide, and 9 ft. 3 in. high from the floor to carline. They will be equipped with Westinghouse air-brakes, Universal bearings, Hien couplers, Thornburgh and Miner draft riggings, McCord journal boxes and box lids, St. Louis flush doors, Murphy-Winslow roofs, and Player trucks.

The Chicago, Rock Island & Pacific is having 10 wide-vestibule passenger coaches built by the Pullman Co., as reported Nov. 16. They will be 63 ft. 10 in. long over drawbars, 10½ ft. wide, and 14 ft. 1 in. high, and will be equipped with Westinghouse brakes, National hollow brake-beams, Janney couplers, McCord journal boxes and box lids, Standard steel platforms and Detroit springs. The same road will build 250 box and 250 stock cars, all of 60,000 lbs. capacity at its Horton, Kan., shops, as mentioned in our last issue. The box cars will be 34 ft. long over end sills, 9 ft. wide over side sills, and 10 ft. 4¾ in. between the sills and running board. The stock cars will be 37 ft. 3 in. long over sills, 9 ft. 4½ in. wide, and as high as the box cars. The underframe and material will be of wood, and the special equipment for both box and stock cars will be as follows: Simplex and Bettendorf bolsters, Sterlingworth brake-beams, Westinghouse air-brakes, Janney couplers, Miner draft riggings and Murphy roofs.

BRIDGE BUILDING.

ATLANTIC CITY, N. J.—We are informed that the bridge proposed by Atlantic County and the Chelsea Heights Land Co. is to be an iron structure and cost about $17,000. The plans are now being made. It is not decided when bids will be asked. John C. Anderson, Clerk of the Board of Chosen Freeholders.

BENWOOD, W. VA.—We are informed that bids will probably be wanted, Jan. 20, by the Bellaire, Benwood & Wheeling Bridge Co. for an iron bridge over the Ohio River between Benwood, W. Va., and Bellaire, Ohio. The structure will be about 1,200 ft. long. J. M. Grady, President, Braddock, Pa.

CHESTER, MASS.—Engineers have been surveying for the Boston & Albany R. R. to do away with six grade crossings in Chester.

CHICAGO, ILL.—Bids are wanted, until Jan. 16, according to report, for five bridges over the Chicago River and the main drainage canal by the Sanitary District Commission.

Fitz Simons & Connell have the contract to build the Clyboun Place bridge at $63,485.

CLEVELAND, OHIO.—Bids will soon be received by the Director of Public Works for widening the approach to the Superior street viaduct.

CORNING, IOWA.—We are informed that contracts will probably be let on Jan. 8 for the metal work (f. o. b. cars Corning) for bridges over Nodaway River of the following lengths: One of 62 ft. and three of 47 ft. Address S. M. Kirkpatrick, Chairman of the Board of Supervisors.

DYERSBURG, TENN.—Three hundred feet of the Illinois Central bridge near Dyersburg was burned Nov. 16.

INDIANAPOLIS, IND.—The County Commissioners will probably build the following bridges during next season: On College avenue and Alabama street, over Fall Creek; on Richmond street over White River, and on Broad Ripple street over Fall Creek, and another over White River.

IOWA CITY, IOWA.—The Supervisors of Johnson County have ordered plans made for a new bridge over the Iowa River at Oxford.

KANSAS CITY, MO.—A resolution was adopted by the City Council, on Nov. 20, to have the Chicago Great Western and the Union Pacific railroads build a bridge over their tracks at Tenth street at a probable cost of $60,000.

LOCKPORT, N. Y.—The Superintendent of Public Works has let a contract for the bridge over the Erie Canal at Pine and Lock streets to the Niagara Construction Co., of Niagara Falls, for about $50,000.

MILWAUKEE, WIS.—A resolution was introduced in the Council on the 19th for a viaduct to span the Menomonie valley from Thirty-fifth street and St. Paul avenue to Thirtieth avenue and South Pierce street. Probable cost $300,000.

At a meeting of the Committee on Railroads of the Common Council last week, a representative of the Chicago, Milwaukee & St. Paul stated that the railroad company was willing to adopt any feasible plan to do away with the grade crossings and was willing to begin work at once.

MINNEAPOLIS, MINN.—The City Engineer informs us that it is expected that the railroad will convert the footbridge on Fourteenth avenue Southwest, between University and Fourth streets, into a wagon bridge, the coming season.

Regarding the bridge proposed over the Mississippi River, connecting Tenth avenue Southeast, with Cedar avenue, the City Engineer says that no money is available at present.

No funds are available for building the proposed bridge at Lyndale avenue over Minnehaha Creek.

PLATTSMOUTH, NEB.—James Robertson, Clerk of Cass County, will receive bids until Dec. 7 for all bridges to be built in that county during 1901.

SIOUX FALLS, S. DAK.—We are told that no money is available for the bridge petitioned for over Bix Sioux River, and mentioned in this column Nov. 16. Henry W. Smith, County Clerk.

SYRACUSE, N. Y.—The city has been petitioned for an appropriation for a bridge over the Oswego Canal at Butternut street. The City Engineer will make estimates.

TROY, N. Y.—A conference of city officers, members of the Chamber of Commerce, and railroad officials was held last week to consider track elevation. The plans and figures were submitted by the City Engineer for depression or elevation of the following streets: Congress street, State street, Broadway, Fulton street, Federal street, Jacob street, Seventh avenue, Fifh avenue, Grand street, Federal street South, Fifth avenue South, River street.

WATERTOWN, WIS.—The City Council has authorized the Board of Public Works to receive bids for building a steel bridge across Rock River at Cady street.

WILMINGTON, DEL.—Plans were submitted to the Levy Court last week for a cantilever bridge at Market street over the Christiana River.

WINNIPEG, MAN.—General Manager McNicoll, of the Canadian Pacific is reported as saying that his company will build a bridge over the river at Winnipeg. The present bridge is owned by the city.

Other Structures.

AETNA, PA.—The American Steel Hoop Company will put in steel bins at its Isabella Furnaces, Aetna, Pa. This will require about 750 tons of steel, which will be furnished from one of the Pittsburgh plants of the American Bridge Company. The bins will be made in accordance with the design of Julian Kennedy, Mechanical Engineer.

CHICAGO, ILL.—Local reports state that three large warehouses will be built at Chicago Heights by the Chicago Heights Land Association. Chas. H. Wacker, President.

Plans are reported under consideration for an enlargement of the union station in Canal street between Madison and Adams streets, used by the following companies: Chicago, Burlington & Quincy, Panhandle, Pennsylvania, Chicago & Alton, and the Chicago, Milwaukee & St. Paul.

The Illinois Central is reported to have made plans for a large freight house to be built at the foot of South Water street. It will be three stories high and about 79 x 396 ft. Estimated cost, $150,000.

GRAND RAPIDS, MICH.—The American Bridge Co. will furnish the steel for the new power station for the Grand Rapids Co. in Grand Rapids, Mich., which will be 111 ft. wide and 147 ft. long.

NEW YORK, N. Y.—The Supervising Architect of the Treasury opened bids in Washington, Nov. 21, for the excavations, foundations, basement walls and structural steel of the new Custom House Building at New York City. There were 13 bids received, as follows: P. J. Carlin & Co., of Brooklyn, $366,937; Charles McCaul, of Philadelphia, $454,027; John Pierce, of New York City, $387,900; Louis Wechsler, of New York City, $423,500; Prescott & Buckley Construction Co., of Plattsburg, N. Y., $439,000; Grace & Hyde Co., of New York City, $424,000; Charles T. Wills, of New York City, $406,029; Norcross Bros., of New York City, $424,000; Thomas J. Reilly, of New York City, $448,640; Isaac A. Hopper & Son, of New York City, $369,610; L. Leach & Son, of Chicago, $337,000; A. R. Whitney, Jr., & Co., of New York City, $403,985, and the Hydraulic Construction Co., of New York City, $465,000.

NILES, OHIO.—The Niles Iron & Steel Co. has been organized, with a capital of $100,000 to make sheets. The contract has been let for its main building, which will be 200 x 124 ft. The contract for part of the machinery is reported let. Officers will soon be elected.

PHILADELPHIA, PA.—Proposals will be received at the Bureau of Yards & Docks, Navy Department, Washington, D. C., until Dec. 8, for building a brick and steel building, 62 x 306 ft., at the League Island Navy Yard.

PITTSBURGH, PA.—James McKay & Co., chain manufacturers at Liberty avenue and Twenty-ninth street, have bought 10 acres near McKees Rocks, to which place the plant will be removed. Plans are said to have been made for the new buildings.

SPOKANE, WASH.—Five bids were received by the Great Northern for building a new depot in Spokane. They were by Gibson & Rollinson, David B. Fotheringham, George McKenzie, P. L. Peterson and Frank Johnson. The amounts were between $150,000 and $175,000.

YOUNGSTOWN, OHIO.—Colonel Geo. D. Wick, Jas. A. Campbell, Geo. L. Fordyce, Edward L. Ford and Wm. Wilkoff have incorporated a company with a capital of $600,000, which will later be increased to $1,000,000. They will build a plant to make iron and steel in Youngstown.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

Canadian Society of Civil Engineers.

At the meeting on Thursday of last week a paper on "The Miner's Inch and the Discharge of Water Through Various Orifices Under Low Heads," by Mr. Thomas Drummond, postponed from last meeting, was read and discussed.

North Western Railway Club.

The regular monthly meeting of the North-West Railway Club was held in the parlors of the Ryan Hotel, St. Paul, Wednesday evening, Nov. 14, 1900. Mr. C. C. Jett, Instructor in Mechanical Engineering at the University of Minnesota, presented an illustrated paper on "The Use of the Stereopticon in Teaching Railroad Signaling."

The discussion on "The Wear of Driving Wheel Tires," which was continued from last meeting, was concluded at this meeting. Discussion was also held on Mr. Zachritz' paper, presented at the October meeting, on "Repairs to Private Line Cars," and "The Utilization of Air Pump Exhaust for Heating Feed Water on Locomotives."

The Engineers' Club of Philadelphia.

A business meeting of the club will be held on Saturday, Dec. 1, at 8 o'clock, at which time nominations for officers for 1901 will be made. The papers of the evening will be "High-Speed Toothed Gearing," by James Christie, and "Interchangeable Gearing," by Wilfred Lewis.

At the meeting held on Nov. 17 Dr. Joseph T. Rothrock, Commissioner of Forestry, presented a paper on the Pennsylvania forests, and what is necessary to their restoration. He gave a complete description of forests as they were, as they are and as they ought to be in Pennsylvania, and pointed out what is necessary to bring about the desired conditions of improvement. The subject was discussed by Messrs. John Birkinbine, Edgar Marburg, John E. Codman, L. Y. Schermerhorn, P. J. A. Maignen and John C. Trautwine, Jr. At the conclusion of the discussion the thanks of the meeting were tendered to Dr. Rothrock for his most interesting and instructive talk.

American Society of Mechanical Engineers.

The forty-second meeting of the American Society of Mechanical Engineers will be held at the house of the Society, 12 West 31st street, Wednesday, Dec. 4 to 7. The convention will open at 9 p. m. Tuesday evening with an address by the President, Mr. Charles H. Morgan. On Wednesday morning there will be a business session, and later the following papers will be presented: "Comparison of Rules for Calculating the Strength of Steam Boilers," H. de B. Parsons; "A Record of the Early Period of High Speed Engineering," Chas. T. Porter; "Steam Engine of Maximum Simplicity and of Highest Thermal Efficiency," Robt. H. Thurston.

Wednesday afternoon and also Friday afternoon will be left without definite assignment. Wednesday evening the following papers will be presented: "Note on Centrifugal Fans for Cupolas and Forges," Wm. Sangster; "Power Plant of the Massachusetts General Hospital," F. W. Dean; "The Construction of Contracts," Reginald P. Bolton; "An American Central Valve Engine," E. T. Adams.

On Thursday the Society will be the guests of Columbia University from 10:30 in the morning. The session for papers will be held at Havemeyer Hall, one of the university buildings, and luncheon will be served. After luncheon the mechanical laboratories, power house, shops, museums, drawing rooms, etc., will be opened for visitors. The papers to be presented at the Thursday morning session are as follows: "Mechanical Integrator Used in Connection with a Spring Dynamometer," Max H. Wickhorst; "Apparatus for Dynamically Testing Steam Engine Indicators," Carleton A. Read; "Tests of the Boilers of the Purdue Locomotive," W. F. M. Goss; "A New Recording Air Pyrometer," W. H. Bristol; "Comparative Value of Different Arrangements of Suction Air Chambers on Pumps," F. Meriam Wheeler.

Thursday evening the usual reception will be held at Sherry's, and the Secretary of the Society informs us that dancing may be expected. Friday morning the closing session will be held, at which the following papers will be presented: "Tests of Centrifugal Pumps," W. B. Gregory; "Hardness, or the Workability of Metals," Wm. J. Keep; "New Principle of Gas Engine Design," Chas. E. Sargent; "Heat Efficiency of the Gas Engine as Modified by Point of Ignition," C. V. Kerr; "Power and Light for the Machine Shop and Foundry," Forrest R. Jones.

Engineering Association of the South.

President Geddes called the eleventh annual meeting of the association to order at 8 p. m., Nov. 8, at Nashville, Tenn. There were present a large number of members, including several from a distance. The ballot for officers resulted in the election of the following: *President*, Major Niles Meriwether, Memphis, Tenn.; *First Vice-President*, Mr.. W. H. Schuerman, Nashville, Tenn.; *Second Vice-President*, G. M. Ingram, Nashville, Tenn.; *Secretary and Treasurer*, H. M. Jones, Nashville, Tenn.; *Resident Directors*: Messrs. James Geddes, E. C. Lewis and R. T. Creighton; for *Directors at Large*: G. F. Blackie, Mt. Pleasant, Tenn.; G. D. Fitzhugh, Birmingham, Ala.; E. E. Betts, Chattanooga, Tenn., and C. S. Brown, Nashville, Tenn.

The Secretary presented his annual report, and the condition of affairs was highly encouraging, and it seems that the association has bright prospects of making the coming year the most successful in its history. During the year closing, 32 new members were added. The active membership list now exceeds 100. The financial statement showed a surplus of $215 at the close of the year, with all obligations paid.

The Secretary recommended that a portion of this be set aside to begin the work of binding the large number of volumes of technical journals which are now on hand. The recommendation was referred to the Finance Committee. It was also recommended that the matter of securing a more convenient location for the library be looked into, and this was referred to the Committee on Rooms and Library. The Committee on Rooms and Library reported that during the year publications had been issued regularly, and that the character of the periodical was creditable. The exchange list had been greatly increased, and the association's work in the line of papers had considerably improved. The advertising

had been liberal, and thanks were tendered those firms who had given their patronage to the publications.

The proposed amendment to the constitution authorizing the establishment of local sections was brought up for discussion. The members of Birmingham, Ala., who will establish a section when the amendment has been adopted, were represented by a committee of three gentlemen, who came to present some amendments to the amendment proposed. The modifications suggested by these gentlemen were discussed and the wisdom of them was apparent. It was therefore by a unanimous vote amended as proposed. The idea in this step is to allow engineers in various localities to organize for the purpose of holding local meetings for the reading and discussion of papers, and establishing headquarters and library locally if they so desire. It seems that in this manner we may be able to reach far more engineers, and thereby extend the usefulness of the organization.

After the business of the evening was over, the members were served with refreshments, and President Geddes presented his annual address, a review of the beginning of the surveys and construction of the L. & N. R. R., in which company's service Major Geddes has been since the fifties.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. Frederick J. Picard, who in 1895 was Vice-President of the Columbus, Sandusky & Hocking, died at Chicago, Ill., Nov. 24, of pneumonia.

—The Governor of Vermont has appointed as members of the Board of Railroad Commissioners Messrs. Jonathan Ross, St. Johnsbury; L. M. Read, Bellows Falls and H. S. Bingham, Bennington.

—Mr. Edward E. Pratt, who died at his home Nov. 21, aged 70 years, was a well-known Bostonian. He was graduated from Harvard College, and was at one time Assistant Treasurer of the Chicago, Burlington & Quincy.

—Mr. J. S. Hobson, who has resigned as Switch and Signal Engineer of the Atchison, Topeka & Santa Fe, is going, early in December, to the Union Switch & Signal Company. He will have a position in the Engineering department at Swissvale, Pa.

—Mr. Andrew Crawford, a Chicago lawyer and financier, died recently in that city. Mr. Crawford was born in Ayrshire, Scotland, Dec. 1, 1831, and came to America as a youth. He went to Chicago in 1872, and immediately took a place among the active men of the city, becoming interested in the Belt Line Railroad and being Vice-President and organizer of the Chicago & Western Indiana Railroad. He was also the organizer of the Graham & Morton Transportation Company. For 20 years Mr. Crawford was a representative of J. P. Morgan & Co., and he was active in the reorganization of North and West Chicago Street Railway interests.

—Mr. Wm. H. Finley has been made Principal Assistant Engineer of the Chicago & Northwestern. He was born near Delaware City, Del., in June, 1862, and his first engineering experience was as a draughtsman with the Edge Moor Iron Co. in the Bridge Department, holding the position from 1881 to 1887. He then became a draughtsman with the Chicago, Milwaukee & St. Paul and shortly afterwards was appointed First Assistant Engineer in the Bridge and Building Department of that road. In 1892 he entered the service of the Chicago & Northwestern, his present company, as Engineer of Bridges, and continued in that position until his recent appointment.

—Mr. Asa M. Mattice has been appointed Chief Engineer of the Westinghouse Electric & Manufacturing Company, and will enter upon his duties in December. Mr. Mattice was for ten years, up to a year ago, Principal Assistant to E. D. Levitt, of Cambridgeport, Mass. During the past year he has been remodeling the Cocheco Cotton Mills, at Dover, N. H. Mr. Mattice is an engineer graduate of the Naval Academy of the class of 1874, of which class Mr. Warren, Vice-President of the Westinghouse Electric & Manufacturing Company, was also a member. He was assistant to Admiral Melville at the beginning of the new navy, and had an important part in the design of the machinery of the "Maine," "San Francisco" and others of the early ships.

—Mr. J. H. Mace on Nov. 1 became Superintendent of Terminals and Local Freight Agent at East St. Louis, Ill., for the Toledo, St. Louis & Western, formerly the Toledo, St. Louis & Kansas City. Mr. Mace was born at O'Fallon, Ill., Dec. 27, 1857. He entered railroad service with the Missouri Pacific at St. Louis as a bill clerk in February, 1883, and on Feb. 1 a year later became chief bill clerk at St. Louis for the St. Louis & San Francisco. He continued with the latter company until his recent appointment, serving as Chief Clerk in the Freight Department, as Local Freight Agent at St. Louis, and then on Jan. 1, 1899, as Superintendent of Terminals in addition to his duties as Agent. One year later he was made Superintendent of the St. Louis division, and continued in that position until Nov. 1 last.

—Mr. G. R. Huntington, the General Superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Minneapolis, Minn., was born in September, 1867, and entered railroad service in May 1883, as office boy in the Superintendent's office of the Southern Minnesota division of the Chicago, Milwaukee & St. Paul at La Crosse, Wis. He continued with the company as operator, agent and Assistant Train Dispatcher until 1888, when he was made Assistant Train Dispatcher of the Wisconsin Division of the Minneapolis, St. Paul & Sault Ste. Marie. He has served since then as Chief Dispatcher to June, 1894, and Chief Clerk to the General Manager to February, 1899. In June following he was made Superintendent of the Wisconsin and Peninsula Divisions and received his present appointment of General Superintendent on Nov. 1 last.

—Mr. Robert Finney, Acting General Superintendent of the Pittsburgh & Western and the Pittsburgh Junction at Allegheny, Pa., was born at Swissvale, Pa., Aug. 10, 1863. He began his railroad work as clerk in the Auditor's office of the Pittsburgh, Titusville & Buffalo at Oil City, Pa., and continued in various clerical capacities for the Allegheny Valley and the Baltimore & Ohio until November, 1883. He then became Chief Clerk to the Superintendent of his present company, the Pittsburgh & Western, at Allegheny. He has since served continuously with this company and the Pittsburgh Junction as Claim Agent until December, 1889; as Superintendent of the Pittsburgh Junction to May, 1894; as Superintendent of the Pittsburgh Junction and General Agent of the Pittsburgh & Western to November, 1900.

—Mr. Geo. O. Perkins is Superintendent of Telegraph of the Mexican Central at Mexico City. He was born at Beloit, Wis., in 1861, and began railroad work as an operator on the Toledo, Wabash & Western in 1877. Since that time he has served as operator with the Indianapolis & St. Louis, the Chicago, Burlington & Quincy, the Chicago & Alton and the Atchison, Topeka & Santa Fe, and was made Train Dispatcher of the latter company during 1880. He was engaged in commercial telegraphy in St. Louis and Chicago from 1881 to 1888, and after occupying various editorial positions on Chicago daily newspapers, he became night manager of the United Press in 1891, and later was Superintendent of News Service. In 1897 he was made Manager of the joint office of the Postal Telegraph Cable Co., and the Mexican Central R. R. at El Paso, Tex., and continued in that position until his present appointment in October last.

—Mr. Francis H. Bainbridge, who succeeds Mr. Wm. H. Finley as Engineer of Bridges of the Chicago & Northwestern, was born in Troy, N. Y., in April, 1863. He was graduated from the Rensselaer Polytechnic Institute in 1884, and the same year began his engineering experience as a transit man and office assistant to Buck & McNulty, of New York City. The following year he became Inspector of Iron for the Chicago & Northern Pacific at Coatesville, Pa. In 1886 he became a draughtsman with the Edge Moor Iron Co., and continued with them until 1893, being advanced to the position of Principal Assistant Engineer of the Bridge Department. He served the Pencoyd Iron Works, the Mt. Vernon Bridge Co. and other companies until 1898, when he became Inspector on the drawbridge at Winona, Minn., for his present company, the Chicago & Northwestern. Afterwards he had charge of building the bridges at Oshkosh and Manitowoc for that company.

—Mr. H. C. Bush became Traffic Manager of the Colorado Midland at Denver, Colo. (as recently noted) on Nov. 1. Mr. Bush was born at Erie, Pa., May 12, 1858, and entered the service of the Empire Fast Freight Line as messenger on June 12, 1871. He continued with the same company until June 1, 1880, serving as clerk from June 1, 1874. Later he served with various roads and freight lines until June, 1885. He was Contracting Agent of the Atlantic & Pacific R. R. at San Francisco, and also Manager of the Atlantic & Pacific Fast Freight Line, in which positions he continued until March 1, 1896. He was Assistant General Freight and Passenger Agent of the Atlantic & Pacific at San Francisco until July 15, 1897, and General Agent of the Freight Department of the Southern California and the Santa Fe Pacific until Aug. 1 this year. He entered the service of his present company, the Colorado Midland, as General Agent on that date and now becomes Traffic Manager.

—Mr. J. Francis Lee, who has recently been appointed General Traffic Manager of the White Pass & Yukon, was born in London, Eng., and was educated at Kings College and Cambridge University. His first railroad service was in the general offices of the London & North Western. He came to America in 1873 when he was 22 years old, and for seven years was in the Accounting and General Passenger departments of the Grand Trunk at Montreal. In 1881 he went to the Chicago, Rock Island & Pacific, where he stayed five years; he then took the position of commercial agent of the freight and passenger departments of the Canadian Pacific at Chicago, and has remained in the service of that company at Chicago ever since. For the last four years he has devoted his attention exclusively to the passenger department, as General Agent. Mr. Lee will be remembered by the older readers of the *Railroad Gazette* as the author of a pamphlet on the development of local passenger traffic.

—Col. Thomas Woolston Yardley died of Bright's disease Nov. 21, at Chicago, at the age of 75 years. Since 1888 he has been connected with the inspection bureau of Robert W. Hunt & Co. as head of the cast-iron pipe department. Col. Yardley had long been identified with steel and iron industries, and had a wide acquaintance. He was born April 23, 1826, in Bucks County, Pennsylvania. His ancestors were Quakers who had come over with William Penn and settled in that state. He was principal partner in the firm of John Burnish & Co., proprietors of the Pottsville Rolling Mills, and later he built the rolling mills of the Elmira Mill Company, at Elmira, N. Y. During the war he was connected with the Department of Military Railroads under Gen. Callum, with the rank of Colonel. Under his direction a rolling mill was built for the Government at Chattanooga, Tenn., for the purpose of rolling rails to repair the destroyed railroad property of the South for the furtherance of military operations. After the close of the war Col. Yardley was engaged with Gen. W. W. Wright on the survey of the Kansas Pacific Railroad, which later became part of the Union Pacific system. He was then connected with the Gaylord Cast Iron Pipe Company of Cincinnati and Newport, Ky. In 1884 he was made Purchasing Agent of the Troy Steel & Iron Company of Troy, N. Y., and after four years he went to Chicago, where he lived until the time of his death.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio Southwestern.—E. Keane, Assistant General Freight Agent at St. Louis, Mo., has resigned.

Canadian Pacific.—We are informed that the reports regarding J. A. Sheffield, Superintendent Sleeping, Dining and Parlor Cars, having resigned, are without foundation.

Central Vermont.—E. D. Nash, heretofore Trainmaster at St. Albans, Vt., has been appointed Superintendent.

Chicago & Northwestern.—T. P. Vaille has been appointed Assistant Tourist Manager for the Chicago, Union Pacific & Northwestern Line, with headquarters at Boston, Mass., effective Nov. 15.

Delaware, Lackawanna & Western.—The title of C. J. Phillips, General Agent, in charge of the operation and traffic of the Bangor & Portland Railway, at Bangor, Pa., will be Superintendent and General Agent. Effective Nov. 24. (See p. 644.)

Farmville & Powhatan.—R. T. Wilson has been appointed Auditor and General Freight and Passenger Agent.

Kansas City Belt.—H. U. Mudge, General Manager of the Atchison, Topeka & Santa Fe, has also been elected President of the K. C. B.

Lake Erie & Western.—D. S. Hill, Assistant to the Chief Engineer, has resigned.

Little Kanawha.—The Directors of this company are: B. E. Cartwright, of Ridgeway, Pa.; C. B. Schaffer and J. G. Bennett, of Pittsburgh; Louis Streuber, of Erie, Pa., and E. E. Smathers, of New York City. All the local Directors have resigned except Henry C. Jackson, President, and A. B. White. Mr. Cartwright will be Vice-President and General Manager. (See R. R. News column.)

Louisville, Evansville & St. Louis.—J. Burke has been appointed Master Mechanic, with headquarters at Princeton, Ind., succeeding F. C. Cleaver.

Midland of Nova Scotia.—The headquarters of this company are at Windsor, N. S.

New York Central & Hudson River.—Walter S. Randolph has been appointed Excursion Manager, with headquarters at 377 Main street, Buffalo, N. Y. Mr. Randolph's territory will comprise the country tributary to the Main Line of the N. Y. C., from Syracuse to Buffalo and Niagara Falls, and also the Western Division branches.

Pacific Mail Steamship.—At a meeting of the Board of Directors, held Nov. 21, Charles H. Tweed (Chairman of the Board of the Southern Pacific), James Speyer (of Speyer & Co.), and Ogden Mills were elected Directors, succeeding Geo. J. Gould, Samuel Thomas and Henry Hart, resigned. Six of the nine Directors of this company are representatives of the Southern Pacific.

Peoria, Decatur & Evansville.—Emerson Chamberlain has been elected President.

Union Pacific.—G. E. Baird, Assistant Superintendent at Evanston, Wyo., has been transferred to the Nebraska Division. Mr. Baird is succeeded by J. W. Egan.

White Pass & Yukon.—J. F. Lee, heretofore General Agent Passenger Department of the Canadian Pacific, has been appointed General Traffic Manager of the W. P. & Y., with headquarters at Seattle, Wash.

Wisconsin Central.—W. G. Moore has been appointed Assistant Treasurer at Milwaukee, Wis., succeeding W. R. Hancock, promoted.

Wisconsin Midland.—The officers of this company, referred to in the Construction column, are: President, W. C. Lawson, Court House, Chicago; Treasurer, Wm. H. Weed, Weyauwega, Wis.; Vice-President and Chief Engineer, A. L. Hutchinson, Weyauwega, Wis.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMSTERDAM & HAGAMAN TRACTION.—Application is before the New York State Board of Railroad Commissioners for this proposed electric line from Amsterdam north about five miles through the village of Rockton to Hagaman. Judge Barlow Dunlap and Fenton Myers, of Amsterdam, are interested.

ARKANSAS SOUTHWESTERN.—An officer writes that surveys are not being made toward Fort Smith, as that extension is in contemplation, but not yet determined upon. The company is building a branch about 10 miles long to Murfreesboro, Ark. The work is mostly earth excavation and is not heavy. It averages about 14,000 cu. yds. to the mile. The maximum grade is 1¼ per cent.; maximum curvature, 4 deg. (Nov. 2, p. 732.)

ATCHISON, TOPEKA & SANTA FE.—Improvements are to be made, according to report, at Pueblo, Colo., including the extension of the present yards and the building of a cut-off about eight miles long south of the city to avoid a hill.

An officer at Los Angeles, Cal., states that no extensive or unusual work is under way, as reported, between San Diego and Santa Ana. (Nov. 9, p. 748.)

ATLANTA, KNOXVILLE & NORTHERN.—An officer denies the report that the company is building a branch from Apalachia to the property of the Apalachian Land & Lumber Co. (Nov. 16, p. 764.)

BALTIMORE & HAVRE DE GRACE.—Application has been made, according to report, for a franchise in Baltimore County, Md., for this electric line from Baltimore northeast about 20 miles to Havre de Grace. R. P. Sword, of Baltimore, is interested.

BALTIMORE & OHIO.—Surveys are reported in progress for the new line between Canton, Ohio, and East Liverpool, to give a shorter route on the line from Pittsburgh to Chicago.

BERKELEY.—Building is begun on the proposed extension to Eutawville, S. C. D. L. Risley, 211 South Tenth street, Philadelphia, is President. (Sept. 21, p. 628.)

CHATTANOOGA SOUTHERN.—The company is making improvements on track, structures, etc. Many cross ties are being put in and the trestles renewed. A large number of the freight cars have been put through the shops and three engines rebuilt. (Oct. 5, p. 661.)

CHICAGO, INDIANA & EASTERN.—The company has given notice to the Indiana Secretary of State of its intention to continue its road to Richmond, Ind., and thence to Cincinnati, Ohio. The company is building between Matthews and Muncie. (Aug. 31, p. 688.)

CHICAGO, JEFFERSON CITY & PACIFIC.—Surveys are made, according to report, for this proposed line from Jefferson City, Mo., southwest about 180 miles to the Kansas State line. Contracts will be let about April 1 next. J. C. Fisher, of Joplin, Mo., is Second Vice-President.

CHICAGO, ROCK ISLAND & PACIFIC.—An officer confirms the report that the company has bought land adjoining its yards at Des Moines, Iowa, but there are no present plans for its use. (Nov. 16, p. 764.)

DAKOTA PACIFIC.—The company has practically completed grading its line from Rapid City, S. Dak., west 32½ miles to Mystic, and track is laid for 10 miles to Scotts Mills. An extension is projected from Rapid City east 215 miles to Chamberlain, with a further extension from Chamberlain northeast 110 miles to Huron. From Mystic an extension is projected west 65 miles to Skull Creek, Wyo. The contract will be let for building 65 miles on Dec. 10, and bids will be asked for rolling stock Feb. 1. (Construction Supplement, July 27, 1900.) Wm. T. Coad is President, and Wm. M. Wright, Chief Engineer, both of Rapid City. (Official.)

DALLAS, FORT WORTH & SOUTHERN.—This company has been organized, with a capital stock of $1,500,000, to build an electric line from Dallas, Tex., to Fort Worth. H. C. Stahl, of Bellevue, Ohio, and Geo. T. Bishop, of Cleveland, Ohio, are interested.

DAYTON & TROY ELECTRIC.—Contracts have been let for building this electric line from Dayton, Ohio, north

about 35 miles through Tippecanoe City to Troy. Valentine Winters, President and General Manager of the Dayton & Western R. R., at Dayton, is among those interested. Contracts reported let are for power house machinery to the Westinghouse Co., for 2,500 tons of 70-lb. rail to the Carnegie Steel Co.; for bridges to the New Castle Bridge Co., New Castle, Ind.

DULUTH, ST CLOUD, GLENCOE & MANKATO.—Engineers, at work since May 1, have about finished the field work for the winter and estimates for building will be completed by Dec. 1. The road is projected from Duluth southwest 287.2 miles via St. Cloud and Glencoe to Albert Lea, with a proposed branch from St. Cloud or Little Falls to Red Lake and the north line of the state. The road is not under contract, but it is expected that at least 100 miles will be built next season. (Construction Supplement, July 27, 1900.) A. H. Reed, of Glencoe, Minn., is President. (Official.)

EASTERN TEXAS.—Surveys are being made for this line from Lufkin, Tex., to Kennard, about 30 miles. The headquarters are at Kennard. R. H. Keith, President of the Central Coal & Coke Co., Kansas City, Mo., is President.

EDGEWATER TERMINAL.—This company was incorporated in Missouri, Nov. 19, with a capital stock of $80,000. Hunter M. Meriweather, Gilmer Meriweather and Benjamin F. Wood are among the incorporators. The company is organized by the Federal Investment Co., of Kansas City to build a new terminal line eight miles long in that city.

ELLIOTT & MOUNT HOLLY.—Building is begun on the extension from Hayneville west about 15 miles to Magnolia, Ark. Two branches aggregating 13 miles are also proposed. (Construction Supplement, July 27, 1900.)

EUREKA & KLAMATH RIVER.—The proposed extension of this line is from Eureka, Cal., north about 100 miles via Arcadia, Mad River, Redwood Creek and Klamath River to Crescent City in Del Norte County. Surveys are made as far as Redwood Creek. It is not determined how far the road will be extended next year. Contracts for grading and track laying will be ordered let in March next. The work is not difficult. The maximum grades are 78 ft. per mile and the maximum curves 8 deg. (Construction Supplement, July 27, 1900.) Several miles of rails will be required in the spring. (Official.)

FAIR HAVEN & WESTVILLE.—This electric railroad company, of New Haven, Conn., will ask for franchises, according to report, from the State Legislature to extend its lines from Yalefield to Derby; from Ansonia to Seymour; from Montowese to Wallingford, and from Mt. Carmel to Cheshire and thence to Southington. All these extensions parallel lines of the New York, New Haven & Hartford.

GRAND TRUNK.—Building is to be begun soon, according to report, on a belt line at Flint, Mich., for the Grand Trunk Western (formerly the Chicago & Grand Trunk), which is to run from Belsay around the city to a connection with the main line near Otterburn.

GREAT NORTHERN.—Messrs. Bodwell & Duff, of Victoria, B. C., have given notice of application to the Legislature of British Columbia for an act to build a steam railroad from a point at the present terminus of the Victoria & Sydney in the city of Victoria, B. C., across the city to the Esquimalt & Nanaimo and the Victoria & Sydney, and to make traffic agreements with these companies. Also to build a line on the mainland from a point at or near the mouth of the Fraser River through Delta and Surrey to a point on a line proposed to intersect with the New Westminster Southern, thence east to a point on the Fraser River at or near Chilliwack, to operate a ferry for passenger and freight cars from the terminus of the Victoria & Sydney Ry. at Sydney to the terminus of the proposed road. (Oct. 19, p. 696.)

INDIANAPOLIS SOUTHERN.—The directors have authorized the issue of $1,000,000 6 per cent. preferred stock, which, it is stated, will be offered at par, one share of common stock being given as a bonus with each three shares of preferred. The line is projected from Rockport, Ind., north 210 miles via Bedford and Fernald to Indianapolis, with a line to New Albany. D. M. Parry, of Indianapolis, is President. (Construction Supplement, July 27, 1900.)

KETTLE RIVER VALLEY.—Wilson & Senkler, of Vancouver, B. C., are giving notice of an application to the British Columbia Legislature for an act to build a line from a point at or near the junction of the Coldwater and Nicola rivers and thence up the Coldwater River about 22 miles, thence easterly through a natural pass to the divide in the West Fork of the Otter River, thence down the fork and along the main river to its junction with the Tullameen River and down that river to its junction with the Similkameen River at Princeton. An alternative route from the junction of the Coldwater and Nicola rivers is to follow the valley of the Nicola River to Nicola Lake; thence along the south shore of Nicola Lake and through the valleys of Quilcheno Creek and One Mile or Graveyard Creek to Princeton. From Princeton the route would follow the valley of the Similkameen River to a point west of Osoyoos Lake, thence east across the Osoyoos River to the divide of Rock Creek and down one of the tributaries of the Kettle River and the Kettle River itself, to the town of Midway; thence along Boundary Creek to Greenwood, and southeast to Grand Forks.

LOS ANGELES & SALT LAKE.—This company has been incorporated with a capital stock of $25,000,000, to build the proposed line from Los Angeles, Cal., northeast about 700 miles via San Bernardino to Salt Lake City, Utah. Among the directors are Senator W. A. Clark, of Montana; R. C. Kerens, of St. Louis, and Perry S. Heath, of Washington, D. C. The Los Angeles Terminal is to be included, according to report. (Nov. 16, p. 764.)

MARYLAND ROADS.—Building is reported under way on line from Salisbury to Bittinger, 14 miles, of which 11 miles is reported graded. Herman Baer, of Salisbury, Md., is General Manager.

MIDDLETOWN STREET.—This electric company will apply to the next Connecticut Legislature, according to report, for a charter to extend its tracks nine miles to Meriden, Conn., indirectly paralleling the New York, New Haven & Hartford.

MISSOURI ROADS.—Perry A. Gibson, of Erie, Pa., is reported the head of a company to build an electric line from Kansas City to St. Joseph.

NASHVILLE, CHATTANOOGA & ST. LOUIS.—R. A. Patton, of South Pittsburg, Tenn., is reported to have a contract for a branch one mile long from Dunlap to new coal mines being opened in Sequatchie County.

OHIO ROADS.—T. L. Childs, of Akron, Ohio, is obtaining franchises for an electric line from Canton, Ohio, north about 25 miles via Uniontown to Akron.

Wm. R. Hattersley, of Toledo, Ohio, is organizing a company to build an electric road from Toledo southwest about 50 miles via Waterville, Fla., Grand Rapids, Liberty, Napoleon and Jewell to Defiance, paralleling the Wabash and the Toledo, St. Louis & Western steam roads.

Harvey Frey has asked for a franchise through Springfield, Ohio, for an interurban electric line from Springfield south about 10 miles to Clifton.

PENNSYLVANIA.—The Philadelphia, Wilmington & Baltimore is said to have secured right of way for a branch from the Delaware division to Tolchester Beach, Del. The line will also include, it is said, a road already built from Clayton to Chesterton and about four miles of new road will be needed.

PERE MARQUETTE.—The improvements proposed by this company consist in equalizing the grades on the main line to bring the maximum to 26.4 ft. per mile. (Construction Supplement, July 27, 1900.) The work is scattered over a distance of 272 miles and in nine or ten different locations. (Official.)

PITTSBURGH & LAKE ERIE.—Surveys are reported in progress for an extension from New Haven, Pa., to Cumberland, Md., to connect with the West Virginia Central & Pittsburgh.

PORTO RICO ROADS.—Mr. Chas. H. Magee, Chief Clerk of the Executive Council of Porto Rico, at San Juan, writes that the Executive Council has granted a franchise to the Port America Co., of New York and Porto Rico, to build and operate 300 miles of railroad on the island. The project is yet in its infancy and detailed information is impossible. Gen. Roy Stone, whose address is probably at Washington, D. C., is the Manager of the Company. (Nov. 2, p. 732.)

QUEEN ANNE'S.—Surveys have been completed for the proposed extension from Queenstown, Md., west about 12 miles to Love Point at the mouth of the Chester River. (Oct. 5, p. 662.)

Efforts are being made, according to report, to induce the railroad to run a steamer betweeen Love Point and Chautauqua Beach, from which latter point it is proposed to run a railroad 27 miles long to connect with a line to Washington, D. C. By the new proposed line the distance from Cape May to Washington would be reduced to 122 miles, it is said, against 229 miles via Philadelphia.

SANDUSKY, NORWALK & SOUTHERN.—This company has been incorporated in Ohio, with a capital stock of $400,000, to build an electric line from Sandusky south about 45 miles via Norwalk to Mansfield. Among the incorporators are Emil G. Schmidt, representing the People's Electric Railway; Truman B. Taylor, representing the Sandusky, Milan & Norwalk Electric Ry., and John Whitworth, President of the Sandusky Chamber of Commerce, all of Sandusky. The People's Electric and the Sandusky, Milan & Norwalk Electric already have a line connecting Sandusky with Norwalk, and it is understood that the two are to be consolidated and the line extended on south.

SEABOARD AIR LINE.—The Charlotte, Monroe & Columbia has been incorporated in South Carolina, with a capital stock of $250,000, to build the line from McBee, S. C., north about 40 miles to Monroe, N. C., on another branch. (Nov. 9, p. 748.)

SOUTHERN INDIANA.—In the issue of Nov. 16 official denial was made that the company will build a branch from Jasonville, Ind., to Terre Haute. The company already has a line between those points and the denial should have been as to building the branch to Jackson Hill.

SOUTHERN PACIFIC.—Rails are being received to relay about 125 miles of track west of San Antonio, Tex., and work is reported begun.

SUFFOLK & CAROLINA.—Grading was begun this week on line from Ryland Station, N. C., to run south 17.2 miles to Edenton.

TECHE ELECTRIC.—This company is reported to have a franchise through New Iberia, La., for a part of an electric line from New Iberia along the Teche Bayou to Morgan City, 45 miles. F. F. Myles, of 822 Gravier street, New Orleans, is an incorporator.

WABASH VALLEY.—Application is being made for right of way in the city of Terre Haute, Ind., for this proposed electric line. A condition made by the company is that the road shall have 30 miles in operation within two years. It is projected south down the valley of the Wabash through Vigo and Sullivan counties. A. M. Higgins, of Terre Haute, is attorney.

WAYCROSS AIR LINE.—Batchaellor & Burtchaell, of Fitzgerald, Ga., are reported to have the contract for the last 17 miles of the extension to Fitzgerald. (Aug. 25, p. 574.)

WISCONSIN MIDLAND.—The route of this proposed electric line is from Berlin, Wis., north about 35 miles via Auroraville, and Poysippi to Brushville, with branches east to Tustin and north to Fremont; north and west to Weyauwega; north and east to Royalton, east to New London and Poysippi, via Pine River, and southwest to Wautona. The route has been surveyed and three-fourths of the right of way secured. The road will be built as soon as the bonds are placed. It will open up a rich farming country and water power can be secured sufficient to operate the dynamos for the entire system. There will probably be two drawbridges and some trestle work. The tracks will be laid with 70 miles of 60-lb. rails. The road is designed to transfer regular freight cars and do a general freight and passenger business. (Nov. 16, p. 764.) The officers are given under Elections and Appointments. (Official.)

WYOMING ROADS.—The Kemmerer Coal Co., of Kemmerer, Wyo., is building a spur to another mine near Kemmerer. This spur connects with a spur already built to mine No. 1. The Utah Construction Co. has the contract. The tracks will be owned by the Oregon Short Line when completed. (Official.)

Surveys are reported made, under Charles Bellamy of Laramie, for a line from Laramie to Gold Hill, 48 miles.

GENERAL RAILROAD NEWS.

BALTIMORE & LEHIGH.—Alexander Brown & Sons, of Baltimore, have asked for an option on the holdings of stockholders at $70 per share. Stockholders may deposit their stock under the offer up to Dec. 19, with the Mercantile Trust & Deposit Co., of Baltimore. The option is to continue until March, 1901, and the payment to be made either in cash or in securities of the new company.

BOSTON & LOWELL (B. & M.).—The stockholders, on Dec. 1, will vote on the issue of $319,000 20-year 3½ per cent. bonds for the payment of a note of $100,000, due July 2, 1901, and for permanent improvements.

CHICAGO, MILWAUKEE & ST. PAUL.—The company has sold $3,000,000 general mortgage 3½ per cent. bonds held in the treasury, to Goldman, Sachs & Co.

COLUMBUS, LIMA & NORTHWESTERN.—The property of this company, whose incorporation was recently noted as successor to the Columbus Northwestern, has been sold, according to report, to the Toledo & Ohio Central. The sale is subject to a contract requiring trains to run between Columbus and St. Marys, Ohio, within 60 days. (Nov. 9, p. 748.)

EEL RIVER.—The Indiana Supreme Court, on Nov. 23, overruled the petition of the Wabash for a rehearing as to the invalidity of the lease of this property by that company. The line will now probably be sold. It extends from Logansport, Ind., to Butler, 94.2 miles, and was leased in perpetuity Oct. 6, 1887, to the Wabash.

ERIE.—The Sharon Ry. Co. is reported to have taken over the New Castle & Shenango Valley Line. Both roads are controlled by the Erie and their tracks form links between New Castle and Sharon, Pa., in the line from Pittsburgh north to the main line.

GRAND TRUNK WESTERN.—This company was incorporated in Michigan and Indiana, Nov. 22, with a capital stock of $6,000,000, to take over the Chicago & Grand Trunk. (Nov. 9, p. 748.)

HIDALGO & NORTHEASTERN.—This property, according to a Mexican press report, has been sold to an English company who propose to make the extension for some time considered from Tortugas northeast to Tuxpan, and thence to Tampico, on the Gulf coast. (Railroad Construction, May 12, 1899, p. 343.)

ILLINOIS CENTRAL.—The stockholders will vote, on Jan. 26, 1901, to increase the capital stock from $60,000,000 to $66,000,000. The proposition is that each stockholder of record Dec. 20, 1900, may subscribe at par for one share of new stock for each 10 shares held. Payments on the new stock must be made in full on or before March 4, 1900, and the new stock will participate in all dividends payable after that date, but not including the dividend of March 1. The funds are to be used for additional equipment and enlarging facilities, including some 80 miles of additional second track.

The stockholders, on Nov. 23, ratified the purchase of the lines of the former Peoria, Decatur & Evansville.

INTEROCEANIC OF MEXICO.—According to the annual report for the year ended June 30, 1900, the gross earnings on 555 miles of line were $4,166,679, which was $7,508 per mile, a gain of $554,087, or 15.34 per cent. over the gross receipts of the year before. The net earnings this year were $1,189,464, which was $346,942, or 41.18 per cent. increase over the preceding year. These are the best returns for any year in the company's history. The directors have decided to call a meeting to recommend the adoption of a resolution to create £1,300,000 ($6,326,000) 4½ per cent. second debenture stock. Of this issue £200,000 is to come under the immediate control of the Board, and not to exceed £150,000 is to be issued for raising working capital. Nine hundred and fifty thousand pounds is to be reserved for the exclusive purpose of redeeming the 7 per cent. "A" debenture stock, of which £735,391 ($3,579,000) is outstanding, and is redeemable at any time upon six months' notice. The remaining £150,000 is to constitute a reserve for requirements on capital account. The new stock is re-payable at par in 1950 at the same time that the "A" debenture stock becomes re-payable at par, and the company may pay off the new 4½ per cent. stock at any time after Jan. 1, 1911, at 105, upon giving six months' notice. If the proposals are approved, the Board proposes to convene a separate meeting of the holders of 7 per cent. "A" debentures, when they will be invited to exchange their holdings for new stock.

KANSAS MIDLAND.—Holders of first mortgage bonds and coupons should present them to Jay F. Shearman, Special Master at Wichita, Kan., on Dec. 7, to receive the proceeds of the recent foreclosure sale. The road is now the property of the St. Louis & San Francisco. (Aug. 3, p. 532.)

LITTLE KANAWHA.—This railroad, which extends from Parkersburg, W. Va., to Palestine, 31 miles, is reported bought by a syndicate of Pennsylvania and New York capitalists, together with extensive coal lands. The report is that the extension is to be built on east 81 miles to Burnsville. Changes in directors are given under Elections and Appointments. (Construction Supplement, July 27, 1900.)

LOUISVILLE & NASHVILLE.—Forty-nine Pensacola & Atlantic bonds have been drawn for payment at 110 and interest, at the company's office, New York, interest to cease Feb. 1, 1901.

LOUISVILLE, EVANSVILLE & ST. LOUIS CONSOLIDATED.—This property was bought at foreclosure on Nov. 22, at Huntington, Ind., by Francis L. Stetson and Victor Morawetz, of New York, representing the Reorganization Committee and the Southern Ry., for $4,030,000. It is understood that the Southern is to take possession about Jan. 1. (Nov. 9, p. 748.)

MISSOURI PACIFIC.—Application has been made to the New York Stock Exchange to list $3,952,000 additional St. Louis, Iron Mountain & Southern 4 per cents of 1929. This is under the refunding plan recently noted. (Nov. 2, p. 732.)

PENNSYLVANIA.—A director is quoted as stating that the company will probably issue $50,000,000 new stock the coming year, giving the stockholders right to subscribe for it at par. Permission must be granted by the State Legislature and the authorized increases asked from the Legislature may be $100,000,000.

SEATTLE & SAN FRANCISCO RAILWAY & NAVIGATION.—According to a Seattle (Wash.) despatch, R. F. Guerin, who was made temporary Receiver Nov. 2, has been discharged by order of the court. (Nov. 16, p. 764

STUTTGART & ARKANSAS RIVER.—Judge Jacob Triber, at Little Rock, Ark., Nov. 20, set aside the sale of this property to John T. Hicks and associates on April 16 last for $60,000. The purchasers have failed to pay the residue of the purchase money. The Master in Chancery, Chas. C. Waters, is ordered to re-advertise the property for sale, the upset price being $40,000. (April 27, p. 280.)